Property Value Citations Collected and Entered into EndNote Database Developed in Support of the Post-Construction Rulemaking as of September 8, 2011

Contents

Property Values –Water Quality

Banicki, J. (2006). "Hot Commodity: Cleaner Water Increases Lake Erie Waterfront Property Values." Twineline **28**(3/4): 3-5.

Bejranonda, S., F. Hitzhusen, et al. (1999). "Agricultural Sedimentation Impacts on Lakeside Property Values." Agricultural and Resources Economics Review **28**(2).

Benson, E., J. Hansen, et al. (1998). "Pricing Residential Amenities: The Value of a View." Journal of Real Estate Finance and Economics **16**(1): 55-73.

Boyle, K., P. Poor, et al. (1999). "Estimating the Demand for Protecting Freshwater Lakes from Eutrophication." American Journal of Agricultural Economics **81**(5): 1118-1122.

Boyle, K. J., S. R. Lawson, et al. (1998). Lakefront Property Owners' Economic Demand for Water Clarity in Maine Lakes, University of Maine: Maine Agricultural and Forest Experiement Station.

Boyle, M. and K. Kiel (2001). "A Survey of House Price Hedonic Studies of the Impact of Environmental Externalities." Journal of Real Estate Literature **9**(2): 117-144.

Braden, J. B. and D. M. Johnston (2004). "Downstream Economic Benefits from Storm-Water Management." Journal of Water Resources Planning & Management **130**(6): 498-505.

> Using benefits transfer methods, this paper assesses the downstream economic consequences of development designs that promote greater on-site water retention. It concludes that on-site retention provides many services that are conceptually distinct but empirically intertwined. Flood mitigation and water quality protection are the most important of these services. For residential properties, the economic value of those services is on the order of 0–5% of market value depending on the difference that retention makes to downstream flood exposure. For water quality improvements, the increases range up to 15% of market value for waterside residences where clarity of the water quality is greatly improved. The increases are much less for improvements that are less visible, properties that are not developed, and properties not adjacent to the watercourse. Our best estimate of total benefits to property owners is 2–5% of property value on average for all properties in the flood plain. The public sector realizes additional benefits through smaller bridges, culverts, and other drainage infrastructure and through increased aquifer recharge. Cities and industries may avoid costly upgrades to waste water treatment facilities if low flows increase. It is difficult to generalize about the economic value of the latter effects. [ABSTRACT FROM AUTHOR]

Brasington, D. M. and D. Hite (2005). "Demand for environmental quality: a spatial hedonic analysis." Regional Science and Urban Economics **35**(1): 57-82.

Cho, S. H., J. M. Bowker, et al. (2006). Measuring the Contribution of Water and Green Space Amenities to Housing Values: An Application and Comparison of Spatially-weighted Hedonic Models.

This study estimates the influence of proximity to water bodies and park amenities on residential housing values in Knox County, Tennessee, using the hedonic price approach. Values for proximity to water bodies and parks are first estimated globally with a standard ordinary least square (OLS) model. A locally weighted regression model is then employed to investigate spatial non-stationarity and generate local estimates for individual sources of each amenity. The local model is able to capture the variability in the quality of water bodies and parks across the county, something a conventional hedonic model using OLS cannot do.

d'Arge, R. and J. Shogren (1989). "Okoboji Experiment: Comparing Non-Market Valuation Techniques in and Unusually Well-Defined Market for Water Quality." Ecological Economics **1**: 251-259.

Dornbusch, D. and S. Barrager (1973). Benefit of Water Pollution Control on Property Values. Washington, DC, US Environmental Protection Agency: Office of Research and Monitoring.

Earnhart, D. (2001). "Combining Revealed and Stated Preference Methods to Value Environmental Amenities at Residential Locations." Land Economics **77**(1): 12-29.

EcoNorthwest (2007). The Economics of Low-Impact Development: A Literature Review. Eugene, OR.

Epp, D. J. and K. S. Al-Ani (1979). "The Effect of Water Quality on Rural Nonfarm Residential Property Values." American Journal of Agricultural Economics **61**(3): 529.

Estimates the relationship between water quality and the value of residential properties adjacent to small rivers and streams. Several parts of real estate market; Single equation estimates of the effect of selected variables on the value of residential properties; Effect of selected variables on the value of residential properties along clean streams and polluted streams.

Feather, T., E. Pettit, et al. (1992). Valuation of Lake Resources through Hedonic Pricing. Fort Belvoir, VA, US Army Corps of Engineers Water Resource Support Center.

Freeman III, A. (1979). "Hedonic Prices, Property Values and Measureing Environmental Benefits: A Survey of the Issues." Scandinavian Journal of Economics **81**(2): 154.

Examines the theoretical basis and the environmental benefits of using hedonic price equations. Derivation of the inverse demand functions for environmental amenities; Applications of the scheme to problems of air quality and urban noise; Analysis of supply and demand.

Gibbs, J., J. Halstead, et al. (2002). "An Hedonic Analysis of the Effects of Lake Water Clarity on New Hampshire Lakefront Properties." Agricultural and Resources Economics Review **31**(1): 39-46.

Horsch, E. J. and D. J. Lewis (2009). "The Effects of Aquatic Invasive Species on Property Values: Evidence from a Quasi-Experiment." Land Economics **85**(3): 391-409.

This study uses hedonic analysis to estimate the effects of a common aquatic invasive species—Eurasian watermilfoil (milfoil)—on property values across an extensive system of over 170 lakes in the northern forest region of Wisconsin. Since milfoil is inadvertently spread by recreational boaters, and since boaters are more likely to visit attractive lakes, variables indicating the presence of milfoil are endogenous in a hedonic model. Using an identification strategy based on a spatial difference-in-differences specification, results indicate that lakes invaded with milfoil experienced an average 13% decrease in land values after invasion. [ABSTRACT FROM AUTHOR]

Hsu, T. (2000). A hedonic study of the effects of lake—water clarity and aquatic plants on lakefront property prices in Vermont (abstract only), University of Maine. **Master Thesis**.

Kashian, R., M. E. Eiswerth, et al. (2006). "Lake Rehabilitation and the Value of Shoreline Real Estate: Evidence from Delavan, Wisconsin." Review of Regional Studies **36**(2): 221-238.

In this article we use the hedonic price model to estimate the effect of a change in water quality on the value of real estate in the lake community of Delavan, Wisconsin. Hedonic techniques show that a $7 million rehabilitation program significantly increased Delavan Lake shoreline property values. Existing research demonstrates that the use of objective water quality measures (as opposed to

subjective measures) is important for estimating the implicit value of water quality in hedonic analyses. This article provides new evidence on the economic benefits of clean water by measuring the change in property values attributed to an observable rehabilitation event. [ABSTRACT FROM AUTHOR]

Kaufman, D. and N. Cloutier (2006). "The Impact of Small Brownfields and Greenspaces on Residential Property Values." Journal of Real Estate Finance & Economics **33**(1): 19-30.

Using a hedonic pricing model, this paper investigates the responsiveness of residential property values in a well-defined inner-city neighborhood of Kenosha, Wisconsin, to the presence of two small former industrial sites contaminated by various environmental pollutants, or brownfields, and a local neighborhood park, or greenspace. Using readily available data on sales and assessments for residential property in close proximity to the brownfields and the greenspace, we estimate well-behaved and statistically significant property value gradients with respect to the park, the environmental amenity, and the brownfields, the environmental disamenities. These functions are then used to estimate the possible impact that brownfield remediation may have on total property value. We estimate that remediation and redevelopment of the brownfields into greenspaces would increase property values for the 890 neighborhood residences between $2.40 and $7.01 million. These results suggest that small brownfields have a measurable impact on property values and that readily accessible data can be used to help local policymakers make decisions on remediation issues. [ABSTRACT FROM AUTHOR]

Kriesel, W., A. Randall, et al. (1993). "Estimating the Benefits of Shore Erosion Protection in Ohio's Lake Erie Housing Market." Water Resources Research **29**(4): 795-801.

Krysel, C., E. Boyer, et al. (2003). Lakeshore Property Values and Water Quality: Evidence from Property Sales in the Mississippi Headwaters Region, Submitted to the Legislative Commission on Minnesota Resources.

Lansford, N. H., Jr. and L. L. Jones (1995). "Recreational and Aesthetic Value of Water Using Hedonic Price Analysis." Journal of Agricultural and Resource Economics **20**(2): 341-355.

Lee, J. S. and M. H. Li (2009). "The impact of detention basin design on residential property value: Case studies using GIS in the hedonic price modeling." Landscape and Urban Planning **89**: 7-16.

Leggett, C. and N. E. Bockstael (2000). "Evidence of the Effects of Water Quality on Residential Land Prices." Journal of Environmental Economics and Management **39**: 121-144.

MacMullan, E. and S. Reich (2009). Low Impact Development At The Local Level: Developers' Experiences and City and County Support, ECONorthwest.

N/A

Mahan, B. L., S. Polasky, et al. (2000). "Valuing Urban Wetlands: A Property Price Approach." Land Economics **76**(1): 100-113.

This study estimates the value of wetland amenities in the Portland, Oregon, metropolitan area using the hedonic property price model. Residential housing and wetland data are used to relate the sales price of a property to structural characteristics, neighborhood attributes, and amenities of wetlands and other environmental characteristics. Measures of interest are distance to and size of wetlands, including distance to four different wetland types; open water, emergent vegetation, scrub-shrub, and forested. Other environmental variables include proximity to parks, lakes, streams, and rivers. Results indicate that wetlands influence the value of residential property and that wetlands influence property values differently than other amenities. Increasing the size of the nearest wetland to a residence by one acre increased the residence's value by $24. Similarly, reducing the distance to the nearest wetland by 1,000 feet increased the value by $436. Home values were not influenced by wetland type. [ABSTRACT FROM AUTHOR]

Maine Department of Environmental Protection More on Dollars and Sense: The Economic Impact of Lake Use and Water Quality, Maine DEP Lake Assessment Program.

Michael, H., K. Boyle, et al. (1996). Water Quality Affects Property Prices:A Case Study of Selected Maine Lakes, Maine Agricultural and Forest Experiment Station: University of Maine.

Michael, H. J., K. J. Boyle, et al. (2000). "Does the Measurement of Environmental Quality Affect Implicit Prices Estimated from Hedonic Models?" Land Economics **76**(2): 283.

Hedonic property value models are often used to derive point estimates for identifying the relationship between environmental quality and property prices. The measurement of the environmental quality variable is often selected based on convenience, but variables reflecting different perceptions about environmental quality may result in implicit prices that vary substantially. This case study derives implicit prices for nine measures of water clarity using hedonic property value models of lakefront properties in Maine. Results show that water clarity variables based on different perceptions may result in differences in implicit prices large enough to potentially affect policy decisions. [ABSTRACT FROM AUTHOR]

Montalto, F., C. Behr, et al. (2007). "Rapid assessment of the cost-effectiveness of low impact development for CSO control." Landscape and Urban Planning **82**(3): 117-131.

This paper presents a simple model for assessing the cost-effectiveness of investments in low impact development (LID) for reducing combined sewer overflows (CSOs) in urban watersheds. LID systems, including green roofs, porous pavement, and stormwater treatment wetlands, are site-specific controls for stormwater runoff. If applied throughout a watershed, LID systems like these can reduce the amount of runoff entering the sewer system and reduce CSOs. To be conservative, we focus solely on the function of LID systems as stormwater management techniques, neglecting the other environmental benefits commonly associated with these technologies. A model is presented that can be used to simulate the cost-effectiveness of reducing CSOs through incremental installation of LID technologies across urban watersheds, when they are introduced alone, or in combination with conventional CSO abatement technologies. The potential reduction in CSOs resulting from various levels of LID adoption is simulated using a modified Rational Method. A life-cycle cost analysis is used to compare LID with other alternatives. Given that LID implementation on private property leads to reduced CSOs, a cost sharing scheme is presented that divides the total LID cost into a private cost fraction (born by the property owner) and a public cost fraction (provided by a public agency). The implications of such a policy are discussed with reference to a CSO-shed that drains to the Gowanus

Canal (Brooklyn, NY). The results indicate that individual LID systems have differing levels of cost-effectiveness in terms of CSO reduction, but that under a variety of performance and cost scenarios a public subsidy to encourage LID installation represents a cost-effective alternative for public agencies to consider in their efforts to reduce CSOs. Future areas of research in this field are outlined.

Palmquist, R. B., F. M. Roka, et al. (1997). "Hog operations, environmental effects, and residential property values." Land Economics **73**(1): 114-124.

Paterson, R. W. and K. J. Boyle (2002). "Out of Sight, Out of Mind? Using GIS to Incorporate Visibility in Hedonic Property Value Models." Land Economics **78**(3): 417-425.

This paper uses GIS data to develop variables representing the physical extent and visibility of surrounding land use/cover features in a hedonic model of a rural/suburban residential housing market. Three equations are estimated to determine if views affect property prices and, further, if omission of visibility variables leads to omitted variable biases. To improve efficiency, first-order spatial autoregressive models are estimated. Results indicate that the visibility measures are important determinants of prices and that their exclusion may lead to incorrect conclusions regarding the significance and signs of other environmental variables. [ABSTRACT FROM AUTHOR]

Phaneuf, D. J., V. K. Smith, et al. (2008). "Integrating property value and local recreation models to value ecosystem services in urban watersheds." Land Economics **84**(3): 361-381.

Poor, P., K. Boyle, et al. (2001). "Objective Versus Subjective Measures of Water Clarity in Hedonic Property Value Models." Land Economics **77**(4): 482-493.

Poor, P., K. Pessagno, et al. (2007). "Exploring the hedonic value of ambient water quality: A local watershed-based study." Ecological Economics **60**: 797-806.

Sigman, H. (2002). "International Spillovers and Water Quality in Rivers: Do Countries Free Ride?" American Economic Review **92**(4): 1152-1159.

This paper looks at the extent of free-riding by comparing water quality in rivers in the presence and absence of spillovers (referring to the physical effect of upstream countries' pollution on downstream pollution). Data on water quality at monitoring stations on rivers around the world are from the United Nations' Global Environmental Monitoring System Water Quality Monitoring Project

(GEMS/Water). The author assembles supplemental data using both traditional country-level sources and a Geographic Information System (GIS) for data specific to the location of the monitoring stations. The pollution measure is biochemical oxygen demand (BOD), a widely measured and commonly generated form of water pollution. The results provide some evidence that international spillovers cause degradation, suggesting that cooperation is incomplete at best. The author presents estimates of the effect of spillover and other determinants of river pollution.

Steinnes, D. N. (1992). "Measuring the economic value of water quality." Annals of Regional Science **26**(2): 171.

The valuation of water quality has proved difficult for economists using hedonic methods. This study, by employing a sample of lakes and considering only land values, is able to overcome many methodological and empirical problems inherent in previous studies. One objective measure of water quality, secchi disc reading, is found to be significant for various alternative specifications of the hedonic model. As explained, however, the results suggest that economic value may be attached to a perceived, rather than actual, measure of water quality. This raises fundamental questions as to how economists and natural scientists can work together to formulate public policy regarding water quality. [ABSTRACT FROM AUTHOR]

Streiner, C. and J. Loomis (1996). "Estimating the Benefits of Urban Stream Restoration Using the Hedonic Price Method." Rivers **5**(4): 267-278.

Walsh, P. (2009). Hedonic Property Values Modeling of Water Quality, Lake Proximity, and Spatial Dependence in Central Florida. Department of Economics. Orlando, FL, University of Central Florida. **Ph.D**.

Walsh, P., J. Milon, et al. (2010). The Spatial Extent of Water Quality Benefits in Urban Housing Markets. Working Paper Series. Washington, DC, U.S. Environmental Protection Agency: National Center for Environmental Economics**:** 35.

Wise, S., J. Braden, et al. (2010). Integrating Valuation Methods to Recognize Green Infrastructure's Multiple Benefits, Center for Neighborhood Technology.

Young, C. T., F (1984). The Influence of Water Quality on the Value of Recreational Properties Adjacent to St. Albans Bay, Vermont, US Department of Agriculture: Economic Research Service: Natural Resource Economics Division.

Property Values – Meta Analysis

Acharya, G. and L. L. Bennett (2001). "Valuing open space and land-use patterns in urban watersheds." Journal of Real Estate Finance and Economics.

Anderson, L. M. and H. K. Cordell (1988). "Influence of Trees on Residential Property Values in Athens, Georgia (U.S.A.): A Survey based on Actual Sales Prices." Landscape and Urban Planning **15**: 153-164.

Anderson, S. T. and S. E. West (2006). "Open space, residential property values, and spatial context." Regional Science and Urban Economics **36**: 773-789.

Asabere, P. K. and F. E. Huffman (2009). "The Relative Impacts of Trails and Greenbelts on Home Price." Journal of Real Estate Finance and Economics **38**: 408-419.

Bark, R. H., D. E. Osgood, et al. (2009). "Habitat preservation and restoration: Do homebuyers have preferences for quality habitat?" Ecological Economics **68**: 1465-1475.

Been, V. and I. Voicu (2008). "The effect of community gardens on neighboring property values." Real Estate Economics **36**: 241-283.

Bin, O. (2005). "A semiparametric hedonic model for valuing wetlands." Applied Economics Letters **12**(10): 597-601.

A semiparametric hedonic price function is estimated to examine the effects of proximity to wetlands on property values using extensive wetland inventory and housing market data from Portland-Oregon, USA. The semiparametric method used in this study allows for estimation of the hedonic price function with flexible functional form and is computationally easier than most non-parametric models. Four general categories of wetlands – open water, emergent vegetation, forested and scrub shrub wetlands – are differentiated. The results indicate that proximity to open water wetlands has a positive association with property values, while the other types of wetlands have either a negative or insignificant relationship. [ABSTRACT FROM AUTHOR]

Bin, O., C. E. Landry, et al. (2008). Riparian Buffers and Hedonic Prices: A Quasi-Experimental Analysis of Residential Property Values in the Neuse River Basin, East Carolina University Working Paper.

Riparian buffers, the strips of vegetation along banks of rivers and streams, have been proposed as a key instrument to protect water quality in the U.S. Riparian buffers impose a restriction on the use of private property limiting harvest and development, but buffers can also provide for aesthetic and recreational benefits that may accrue to property owners. With data from the Neuse River Basin in North Carolina, this study attempts to provide empirical evidence on the effect of a mandatory buffer rule on the value of riparian properties. Spatial autoregressive hedonic models are estimated within a quasi-experimental framework using the imposition of the buffer rule as the treatment and non-riparian properties as a control group. Results indicate that riparian property generally commands a high premium. We find no evidence, however, that the mandatory buffer rule has had a significant impact on riparian property values when compared with the control group.

Bin, O. and S. Polasky (2003). "Valuing Inland and Coastal Wetlands in a Rural Setting Using Parametric and Semi-Parametric Hedonic Models."

Bin, O. and S. Polasky (2005). "Evidence on the Amenity Value of Wetlands in a Rural Setting." Journal of Agricultural and Applied Economics **37**(3): 589-602.

Bolitzer, B. and N. R. Netusil (2000). "The impact of open spaces on property values in Portland, Oregon." Journal of Environmental Management **59**: 185-193.

Bowman, T., J. Thompson, et al. (2009). "Valuation of open space and conservation features in residential subdivisions." Journal of Environmental Management **90**: 321-330.

Cape Ann, E. Open Space Proximity and Land Values.

N/A

Cho, S. H., J. M. Bowker, et al. (2006). Measuring the Contribution of Water and Green Space Amenities to Housing Values: An Application and Comparison of Spatially-weighted Hedonic Models. S.-H. Cho, J. M. Bowker and W. M. Park.

This study estimates the influence of proximity to water bodies and park amenities on residential housing values in Knox County, Tennessee, using the hedonic price approach. Values for proximity to water bodies and parks are first estimated globally with a standard ordinary least square (OLS) model. A locally weighted regression model is then employed to investigate spatial non-stationarity and generate local estimates for individual sources of each amenity. The local model is able to capture the variability in the quality of water bodies and parks across the county, something a conventional hedonic model using OLS cannot do.

Cho, S. H., C. D. Clark, et al. (2009). "Spatial and Temporal Variation in the Housing Market Values of Lot Size and Open Space." Land Economics **85**: 51-73.

Cho, S. H., N. C. Poudyal, et al. (2008). "Spatial analysis of the amenity value of green open space." Ecological Economics **66**: 403-416.

Cho, S.-H. and R. K. Roberts (2007). "Cure for Urban Sprawl: Measuring the Ratio of Marginal Implicit Prices of Density-to-Lot-Size." Review of Agricultural Economics **29**(3): 572-579.

Colby, B. G. and S. Wishart (2002). "Quantifying the Influence of Desert Riparian Areas on Residential Property Values." The Appraisal Journal **July**.

DesRosiers, F., M. Theriault, et al. (2002). "Landscaping and House Values: An Empirical Investigation." JRER **23**.

This article is the winner of the Real Estate Valuation manuscript prize (sponsored by The Appraisal Institute) presented at the 2001 American Real Estate Society Annual Meeting. This hedonic study investigates the effect of landscaping on house values, based on a detailed field survey of 760 singlefamily homes sold between 1993 and 2000 on the territory of the Quebec Urban Community. Environmental information includes thirty-one landscaping attributes of both houses and their immediate environment. By and large, a positive tree cover differential between the property and its immediate neighborhood, provided it is not excessive, translates into a higher house value. Findings also suggest that the positive price impact of a good tree cover in the visible surroundings is all the more enhanced in areas with a high proportion of retired persons. Finally, a high percentage of lawn cover as well as features such as flower arrangements, rock plants, the presence of a hedge, etc. all command a substantial market premium.

Donovan, G. H. and D. T. Butry (2008). Market-Based Approaches to Tree Valuation. Arborist News.

recent four-part series in Arborist News outlined different appraisal processes used to value urban trees. The final article in the series described the three generally accepted approaches to tree valuation: the sales comparison approach, the cost approach, and the income capitalization approach. The author, D. Logan Nelson, noted that the sales comparison approach has the appeal of being based on observed market transactions. In this article, we outline the strengths and weaknesses of the sales comparison approach, define what type of value it estimates, and introduce the hedonic price method as an alternative, market-based method for valuing urban trees. We present results from a recent study in Portland, Oregon, that examined the value of street trees using the hedonic price method. The results from our study, although based on the Portland housing market, provide some broader insights into how trees affect house values.

Donovan, G. H. and D. T. Butry (2010). "Trees in the city: Valuing street trees in Portland, Oregon." Landscape and Urban Planning **94**(2): 77-83.

Doss, C. R. and S. J. Taff (1996). "The Influence of Wetland Type and Wetland Proximity on Residential Property Values." Journal of Agricultural and Resource Economics **21**(1): 120-129.

Using detailed residential housing and wetland location data, we determine relative preferences for proximity to four broad classes of wetlands, as expressed through housing values. Implicit prices for proximity to open-water and scrub-shrub wetlands are relatively higher than those for emergent-vegetation and forested wetlands.

Earnhart, D. (2001). "Combining Revealed and Stated Preference Methods to Value Environmental Amenities at Residential Locations." Land Economics **77**(1): 12-29.

Embrace Open, S. (2009). Hennepin County Economic Analysis - Executive Summary.

Embrace Open Space commissioned an economic study of home values in Hennepin County to quantify the financial impact of proximity to open spaces on the value of nearby single-family homes. As communities in the Twin Cities metropolitan area begin to plan now for one million new residents coming to the region by 2030, such results can help communities better understand how decisions to conserve open space might affect property tax revenues.

Espey, M. and K. Owusu-Edusei (2001). "Neighborhood Parks and Residential Property Values in Greenville, South Carolina." Journal of Agricultural and Applied Economics **33**(3): 487-492.

Geoghegan, J. (2002). "The value of open spaces in residential land use." Land Use Policy **19**: 91-98.

Geoghegan, J., L. Lynch, et al. (2003). "Capitalization of Open Spaces into Housing Values and the Residential Property Tax Revenue Impacts of Agricultural Easement Programs." Agricultural and Resource Economics Review **32**(1): 33-45.

Using a unique spatial database, a hedonic model is developed to estimate the value to nearby residents of open space purchased through agricultural preservation programs in three Maryland counties. After correcting for endogeneity and spatial autocorrelation, the estimated coefficients are used to calculate the potential changes in housing values for a given change in neighborhood open space following an agricultural easement purchase. Then, using the current residential property tax for each parcel, the expected increase in county tax revenue is computed and this revenue is compared to the cost of preserving the lands.

Geoghegan, J., L. A. Wainger, et al. (1997). "Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS." Ecological Economics **23**: 251-264.

Hardie, I., E. Lichtenberg, et al. (2007). "Regulation, open space, and the value of land undergoing residential subdivision." Land Economics **83**: 458-474.

Heintzelman, M. A. (2010). "Measuring the Property-Value Effects of Local Land Use and Preservation Referenda." Land Economics **86**: 22-47.

Hitzhusen, F. J., N. Yen, et al. (2007). Willingness to Pay for LID Environmental Benefits, ASCE.

Hobden, D. W., G. E. Laughton, et al. (2004). "Green space borders--a tangible benefit? Evidence from four neighbourhoods in Surrey, British Columbia, 1980-2001." Land Use Policy **21**(2): 129-138.

Irwin, E. G. (2002). "The effects of open space on residential property values." Land Economics **78**: 465-480.

Irwin, E. G. (2002). "The Effects of Open Space on Residential Property Values." Land Economics **78**(4): 465.

The marginal values of different open space attributes are tested using a hedonic pricing model with residential sales data from central Maryland. The identification problems that arise due to endogenous land use spillovers and unobserved spatial correlation are addressed using instrumental variables estimation with a randomly drawn subset of the data that omits nearest neighbors. Results show a premium associated with permanently preserved open space relative to developable agricultural and forested lands and support the hypothesis that open space is most valued for providing an absence of development, rather than for providing a particular bundle of open space amenities. [ABSTRACT FROM AUTHOR]

Irwin, E. G. and N. E. Bockstael (2001). "The problem of identifying land use spillovers: Measuring the effects of open space on residential property values." American Journal of Agricultural Economics **83**: 698-704.

Johnston, R. J., S. K. Swallow, et al. (2002). "Spatial Factors and Stated Preference Values for Public Goods: Considerations for Rural Land Use." Land Economics **78**(4): 481-500.

Kaufman, D. and N. Cloutier (2006). "The Impact of Small Brownfields and Greenspaces on Residential Property Values." Journal of Real Estate Finance & Economics **33**(1): 19-30.

Using a hedonic pricing model, this paper investigates the responsiveness of residential property values in a well-defined inner-city neighborhood of Kenosha, Wisconsin, to the presence of two small former industrial sites contaminated by various environmental pollutants, or brownfields, and a local neighborhood park, or greenspace. Using readily available data on sales and assessments for residential property in close proximity to the brownfields and the greenspace, we estimate well-behaved and statistically significant property value gradients with respect to the park, the environmental amenity, and the brownfields, the environmental disamenities. These functions are then used to estimate the possible impact that brownfield remediation may have on total property value. We estimate that remediation and redevelopment of the brownfields into greenspaces would increase property values for the 890 neighborhood residences between $2.40 and $7.01 million. These results suggest that small brownfields have a measurable impact on property values and that readily accessible data can be used to help local policymakers make decisions on remediation issues. [ABSTRACT FROM AUTHOR]

Kaufman, D. and N. Cloutier (2006). "The Impact of Small Brownfields and Greenspaces on Residential Property Values." Journal of Real Estate Finance & Economics **33**(1): 19-30.

Using a hedonic pricing model, this paper investigates the responsiveness of residential property values in a well-defined inner-city neighborhood of Kenosha, Wisconsin, to the presence of two small former industrial sites contaminated by various environmental pollutants, or brownfields, and a local neighborhood park, or greenspace. Using readily available data on sales and assessments for residential property in close proximity to the brownfields and the greenspace, we estimate well-behaved and statistically significant property value gradients with respect to the park, the environmental amenity, and the brownfields, the environmental disamenities. These functions are then used to estimate the possible impact that brownfield remediation may have on total property value. We estimate that remediation and redevelopment of the brownfields into greenspaces would increase property values for the 890 neighborhood residences between $2.40 and $7.01 million. These results suggest that small brownfields have a measurable impact on property values and that readily accessible data can be used to help local policymakers make decisions on remediation issues. [ABSTRACT FROM AUTHOR]

Klaiber, H. A. and D. J. Phaneuf (2010). "Valuing open space in a residential sorting model of the Twin Cities." Journal of Environmental Economics and Management **60**(2): 57-77.

Kopits, E., V. McConnell, et al. (2007). "The trade-off between private lots and public open space in subdivisions at the urban-rural fringe." American Journal of Agricultural Economics **89**: 1191-1197.

Lake, M. B. and K. W. Easter (2002). Hedonic Valuation of Proximity to Natural Areas and Farmland in Dakota County, Minnesota. **Staff Paper P02-12**.

Lee, J. S. and M. H. Li (2009). "The impact of detention basin design on residential property value: Case studies using GIS in the hedonic price modeling." Landscape and Urban Planning **89**: 7-16.

Luttik, J. (2000). "The value of trees, water and open space as reflected by house prices in the Netherlands." Landscape and Urban Planning **48**: 161-167.

An attractive environment is likely to influence house prices. Houses in attractive settings will have an added value over similar, less favourably located houses. This effect is intuitively felt, but does it always occur? Which environmental factors make a location an attractive place to live in? The present study explored the effect of different environmental factors on house prices. The research method was the hedonic pricing method, which uses statistical analysis to estimate that part of a price due to a particular attribute. Nearly 3000 house transactions, in eight towns or regions in the Netherlands, were studied to estimate the effect of environmental attributes on transaction prices. Some of the most salient results were as follows. We found the largest increases in house prices due to environmental factors (up to 28%) for houses with a garden facing water, which is connected to a sizeable lake. We were also able to demonstrate that a pleasant view can lead to a considerable increase in house price, particularly if the house overlooks water (8±10%) or open space (6±12%). In addition, the analysis revealed that house price varies by landscape type. Attractive landscape types were shown to attract a premium of 5±12% over less attractive environmental settings. # 2000 Elsevier Science B.V. All rights reserved. Keywords: Economic valuation; Trees; Water; Open space; House prices

Lutzenhiser, M. and N. R. Netusil (2001). "The Effect of Open Spaces on a Home's Sale Price." Contemporary Economic Policy **19**(3): 291-298.

The relationship between a home's sale price and its proximity to different open spaces types is explored using a data set comprised of single-family home sales in the city of Portland, within Multnomah County, between 1990 and 1992. Homes located within 1,500 feet of a natural area park, where more than 50% of the park is preserved in native and/or natural vegetation, are found to experience, on average, the largest increase in sale price. The open space size that maximizes a home's sale price is calculated for each open space type. Natural area parks require the largest acreage to maximize sale price, and specialty parks are found to have the largest potential effect on a home's sale price. A zonal approach is used to examine the relationship between a home's sale price and its distance to an open space. Natural area parks and specialty parks are found to have a positive and statistically significant effect on a home's sale price for each zone studied. Homes located adjacent to golf courses (within 200 feet) are estimated to experience the largest increase in sale price due to open space proximity although the effect drops off quickly as distance from the golf course increases.

Mahan, B. L., S. Polasky, et al. (2000). "Valuing Urban Wetlands: A Property Price Approach." Land Economics **76**(1): 100-113.

This study estimates the value of wetland amenities in the Portland, Oregon, metropolitan area using the hedonic property price model. Residential housing and wetland data are used to relate the sales price of a property to structural characteristics, neighborhood attributes, and amenities of wetlands and other environmental characteristics. Measures of interest are distance to and size of wetlands, including distance to four different wetland types; open water, emergent vegetation, scrub-shrub, and forested. Other environmental variables include proximity to parks, lakes, streams, and rivers. Results indicate that wetlands influence the value of residential property and that wetlands influence property values differently than other amenities. Increasing the size of the nearest wetland to a residence by one acre increased the residence's value by $24. Similarly, reducing the distance to the nearest wetland by 1,000 feet increased the value by $436. Home values were not influenced by wetland type.

Mansfield, C., S. K. Pattanayak, et al. (2005). "Shades of Green: Measuring the value of urban forests in the housing market." Journal of Forest Economics **11**: 177-199.

Martin, R. and T. Carter (2009). Impact of Endangered Species Act Standards on Vacant Land Prices in Cherokee County, Georgia, ETOWAH.

The spatial growth of urban areas is associated with a large number of actual and potential problems. These problems include such things as increased traffic congestion, overburdened public infrastructure, and decreased access to employment opportunities for lower-skilled central city residents. Additionally, since much of the new development that is spawned by the expansion of urban areas into previously rural ones occurs in undeveloped areas, there are a host of

environmental concerns associated with such growth such as habitat destruction and air quality impacts. One area of particular concern is the impact of increased levels of development on the quality of streams and rivers. Studies have documented an effect on both the biotic and abiotic components of the aquatic ecosystem in relationship to urban land cover (e.g. Helms et al, 2009; Schoonover et al, 2006; Wickham et al, 2008). Researchers have collectively classified the urban effect on streams as the "urban stream syndrome," having "symptoms" of flashier hydrographs, higher pollutant levels, highly modified channel geomorphology and decreased biotic richness than its non-urban counterparts (Walsh et al, 2005). In response to these urban threats to river and stream quality, state and local governments have sought policy approaches that can preserve river and stream quality while not stifling the ability of newly developing areas to benefit from growth. This can be a delicate balancing act, as regulations that are too stringent or lead to excessively long approval periods can make it difficult for supply to keep up with demand and lead to decreased housing affordability. Several recent studies in urban economics have linked reduced housing affordability with high levels of growth controls (Quigley and Raphael, 2005, Glaeser et al, 2005). At the same time, however, regulations that are too lenient run the risk of allowing new development to negatively impact local environments such as aquatic ecosystems. This study looks at one particular set of development standards in Cherokee County, Georgia, that have as their primary focus the protection of endangered fish species. The goal is to determine whether the standards impact vacant land values, and, if so, in what direction. The rest of the paper is organized as follows. The next section profiles Cherokee County and the set of policy approaches employed in the county. The following section outlines the data used in the study and provides a summary of the data. Section IV explains the empirical approach employed in the study, and is followed by a section that presents the study's results. Finally, a concluding section summarizes our findings and suggests areas for future research.

Mikelbank, B. M. and Center for Housing Policy & Research (2006). Hedonic Analysis of Riparian/ Wetland Setbacks, Prepared for Chagrin River Watershed Partners, Inc. Cleveland, Cleveland State University, Maxine Goodman Levin College of Urban Affairs.

Mohamed, R. (2006). "The economics of conservation subdivisions - Price premiums, improvement costs, and absorption." Urban Affairs Review **41**: 376-399.

Mooney, S. and L. M. Eisgruber (2001). "The influence of riparian protection measures on residential property values: The case of the oregon plan for salmon and watersheds." Journal of Real Estate Finance and Economics.

Morrow-Jones, H. A., E. G. Irwin, et al. (2004). "Consumer preference for neotraditional neighborhood characteristics." Housing Policy Debate **15**: 171-202.

Moscovitch, E. (2007). The Economic Impact of Proximity to Open Space on Single-Family Home Values in Washington County, Minnesota, Embrace Open Space.

N/A

Munroe, D. K. (2007). "Exploring the determinants of spatial pattern in residential land markets: amenities and disamenities in Charlotte, NC, USA." Environment and Planning B-Planning & Design **34**: 336-354.

Netusil, N. R. (2005). "The Effect of Environmental Zoning and Amenities on Property Values: Portland, Oregon." Land Economics **81**(2): 227-246.

This study uses the hedonic-price-method to examine how environmental zoning and amenities are related to the price of single-family residential properties sold between 1999 and 2001 in Portland, Oregon. The impact of environmental zoning is found to vary with the type of environmental zoning and the property's location. Amenities are found to influence a property's sale price with the effect varying by amenity type and proximity. The net effect on a property's sales price is dependent on the type of environmental zoning, location in the study area, amenities on the property, and amenities in the surrounding neighborhood. (JEL R14, R52)

Netusil, N. R. (2006). "Economic Valuation of Riparian Corridors and Upland Wildlife Habitat in an Urban Watershed." Journal of Contemporary Water Research & Education(134): 39-45.

N/A

Netusil, N. R., S. Chattopadhyay, et al. (2010). "Estimating the Demand for Tree Canopy: A Second-Stage Hedonic Price Analysis in Portland, Oregon." Land Economics **86**(2): 281-293.

The benefits of large patches of tree canopy are estimated by applying a hedonic price model to the sale of single-family residential properties in Portland, Oregon. The first-stage analysis provides evidence of diminishing returns from increasing tree canopy past a certain level. The second-stage analysis uses a survey of property owners' preferences and socioeconomic characteristics to overcome the problem of endogeneity. Average benefit estimates for the mean canopy cover within [1/4] mile of properties in the study area, using the second-stage model, are between 0.75% and 2.52% of the mean sale price. (JEL Q21, Q51)

Nicholls, S. and J. L. Crompton (2005). "The Impact of Greenways on Property Values: Evidence from Austin, Texas." Journal of Leisure Research **37**(3): 321-341.

The effect of greenways on surrounding residential property values remains somewhat of an unknown quantity. Though several studies have ascertained that nearby residents tend to view greenways as positive or neutral amenities that increase or have no discernible impact on property values and saleability, these results are mostly based on anecdote rather than actual market data. Using the hedonic pricing method, this study demonstrates that greenways may indeed have significant positive impacts on proximate properties' sales prices. Adjacency

to a greenbelt produced significant property value premiums in two of three neighborhoods. Physical access to a greenbelt had a significant, positive impact in one case, but was insignificant in two others. No negative greenway impacts were recorded. KEYWORDS: Greenways, property values, hedonic pricing.

Pincetl, S., J. Wolch, et al. (2003). TOWARD A SUSTAINABLE LOS ANGELES: A "NATURE'S SERVICES" APPROACH A Second Year Report to the John Randolph Haynes and Dora Haynes Foundation, Center for Sustainable Cities, University of Southern California.

Poudyal, N. C., D. G. Hodges, et al. (2009). "A hedonic analysis of the demand for and benefits of urban recreation parks." Land Use Policy **26**: 975-983.

Poudyal, N. C., D. G. Hodges, et al. (2009). "Valuing diversity and spatial pattern of open space plots in urban neighborhoods." Forest Policy and Economics **11**: 194-201.

Qiu, Z., T. Prato, et al. (2006). "ECONOMIC VALUATION OF RIPARIAN BUFFER AND OPEN SPACE IN A SUBURBAN WATERSHED¹." Journal of the American Water Resources Association **42**(6): 1583-1596.

This study evaluates the economic value of riparian buffers and open space in a suburban watershed through two nonmarket valuation methods. A contingent valuation survey was implemented in the Dardenne Creek watershed, a suburban watershed of the St. Louis metropolitan area in Missouri, to evaluate the residents' perceptions of and willingness to pay (WTP) for adopting riparian buffers and preserving farmland in a hypothetical real estate market. A hedonic pricing model based on actual sale prices of homes in the watershed was applied to estimate the market value of open space and other environmental conditions such as flood zone and stream proximity in the study area. The results showed that residents' WTP was consistent with the economic values of open space and proximity to streams embedded in existing home prices. Through a better understanding of residents' perceptions and values, riparian buffer and open space programs can be designed and promoted to achieve greater implementation success and environmental benefit.

Ready, R. and C. Abdalla (2003). The Impact of Open Space and Potential Local Disamenities on Residential Property Values in Berks County, Pennsylvania, Pennsylvania University.

Ready, R. C. and C. W. Abdalla (2005). "The Amenity and Disamenity Impacts of Agriculture: Estimates from a Hedonic Pricing Model." American Journal of Agricultural Economics **87**(2): 314-326.

The positive and negative externalities from farmland are increasingly a focus of public policy discussion about agriculture and land use. A GIS-based hedonic pricing model shows that agricultural open space increases nearby residential property values, but larger-scale animal operations and mushroom production have negative impacts. Animal production facilities with as few as 200 animal

equivalent units reduce nearby property values, but larger facilities do not necessarily generate larger impacts. Because they tend to occur together, the negative impacts of animal agriculture and the positive impacts of open space must be simultaneously modeled to avoid omitted variable bias. [ABSTRACT FROM AUTHOR]

Reynolds, J. E. and A. Regalado (2002). "The Effects of Wetlands and Other Factors on Rural Land Values." The Appraisal Journal **72**.

Sander, H., S. Polasky, et al. (2010). "The value of urban tree cover: A hedonic property price model in Ramsey and Dakota Counties, Minnesota, USA." Ecological Economics **69**(8): 1646-1656.

Sander, H. A. and S. Polasky (2009). "The value of views and open space: Estimates from a hedonic pricing model for Ramsey County, Minnesota, USA." Land Use Policy **26**: 837-845.

Schultz, S. and N. Schmitz (2008). How Water Resources Limit and/or Promote Residential Housing Developments in Douglas County: Final Research Report, University of Nebraska at Omaha, Economics Dept.

Shultz, S. D. and D. A. King (2001). "The use of census data for hedonic price estimates of open-space amenities and land use." Journal of Real Estate Finance and Economics **22**(2): 239-239.

Smith, V. K., C. Poulos, et al. (2002). "Treating open space as an urban amenity." Resource and Energy Economics **24**: 107-129.

Stetler, K. M., T. J. Venn, et al. (2010). "The effects of wildfire and environmental amenities on property values in northwest Montana, USA." Ecological Economics **69**(11): 2233-2243.

Thériault, M., Y. Kesten, et al. (2002). The Impact of Mature Trees on House Values and on Residential Location Choices in Quebec City**:** 478-483.

Thompson, R. (2008). Cost Benefit Analysis of Conservation Developments in Western North Carolina. Nicholas School of the Environment and Earth Sciences of Duke University, Duke University. **Master of Environmental Management**.

Thorsnes, P. (2002). "The Value of a Suburban Forest Preserve: Estimates from Sales of Vacant Residential Building Lots." Land Economics **78**(3): 426-441.

This paper reports estimates of the market value of proximity to forest preserves as capitalized into the sale prices of vacant building lots in residential subdivisions that on one side border a preserve. The results indicate that building lots that border the preserve sell al premia of about $5,800 to $8,400(19% to 35% of tot price). 'These proximity premia appear to he highly localized. Estimates ohtained from bservations on subsequent sales of houses (rather than of vacant building lots) are larger and less precisely estimated, which sugests that omitted house characteristics may bias estimates of amenity value. (JRL Q23)

Towe, C. (2009). "A Valuation of Subdivision Open Space by Type." American Journal of Agricultural Economics **91**(5): 1319-1325.

Troy, A. and J. M. Grove (2008). "Property values, parks, and crime: A hedonic analysis in Baltimore, MD." Landscape and Urban Planning **87**: 233-245.

Wachter, S. (2005). The Determinants of Neighborhood Transformations in Philadelphia Identification and Analysis: The New Kensington Pilot Study.

Wachter, S. and K. C. Gillen (2006). Public Investment Strategies: How They Matter for Neighborhoods in Philadelphia - Identification and Analysis.

Wachter, S. and G. Wong (2008). "What is a tree worth? Green-city Strategies and Housing Prices." Real Estate Economics **36**(2): 213-239.

White, E. M. and L. A. Leefers (2007). "Influence of Natural Amenities on Residential Property Values in a Rural Setting." Society and Natural Resources **20**: 659-667.

Hedonic pricing has been used to identify values of nonmarket natural resource amenities. Most of these studies have been completed in suburban or urban communities rather than rural areas. The hedonic pricing study presented here includes developed residential parcel transactions occurring in a rural county in Michigan. We develop two hedonic pricing models using transaction data for two rural residential parcel types: developedparcels located in subdivisions, and developedparcels not located in subdivisions. Proximity to lakes and subdivision open areas positively affected the values of some parcel types, while proximity to forested land, publicly owned land, streams, and a National Scenic River did not have a positive influence. Results found in this study completed in a rural setting contrast with the results of other studies completed in suburban and urban settings.

Williams, E. S. (2003). Hydrologic and Economic Impacts of Alternative Residential Land Development Methods.

Williams, E. S. and W. R. Wise (2009). "Economic Impacts of Alternative Approaches to Storm-Water Management and Land Development." Journal of Water Resources Planning and Management-Asce **135**: 537-546.

Wu, J., R. M. Adams, et al. (2004). "Amenities in an Urban Equilibrium Model: Residential Development in Portland, Oregon." Land Economics **80**(1): 19-32.

This paper estimates the effects of open space and other amenities on housing prices and development density in Portland, Oregon, within the framework of an urban equilibrium model. Amenities are important: households are willing to pay more for newer houses located in areas of less dense development, with more open space, better views, less traffic congestion, and near amenity locations. For the developers, increases in housing prices results in providing more large houses, which will ultimately lead to higher density and lower housing prices. A simulation analysis evaluates policy implications and indicates substantial benefits from alterations in housing patterns. (JEL R11, R31)

Property Values – Additional Studies

Acharya, G. and L. L. Bennett (2001). "Valuing open space and land-use patterns in urban watersheds." Journal of Real Estate Finance and Economics.

Acharya, G. and L. L. Bennett (2001). "Valuing open space and land-use patterns in urban watersheds." Journal of Real Estate Finance and Economics.

Allen, P. G. and T. H. Stevens (1983). Use of Hedonic Price Technique to Evaluate Wetlands, Water Resources Research Center, Massachusetts University, Amherst.

Anderson, K., T. Anthony, et al. (2008). Rock Creek Sustainability Initiative Research Findings.

N/A

Anderson, L. M. and H. K. Cordell (1988). "Influence of Trees on Residential Property Values in Athens, Georgia (U.S.A.): A Survey based on Actual Sales Prices." Landscape and Urban Planning **15**: 153-164.

Anderson, S. T. and S. E. West (2006). "Open space, residential property values, and spatial context." Regional Science and Urban Economics **36**: 773-789.

Anderson, S. T. and S. E. West (2006). "Open space, residential property values, and spatial context." Regional Science and Urban Economics **36**: 773-789.

Anton, P. A. (2005). The Economic Value of Open Space: Implications for Land Use Decisions.

N/A

Asabere, P. K. and F. E. Huffman (2009). "The Relative Impacts of Trails and Greenbelts on Home Price." Journal of Real Estate Finance and Economics **38**: 408-419.

Banzhaf, H. S. and P. Jawahar (2005). Public Benefits of Undeveloped Lands on Urban Outskirts: Non-Market Valuation Studies and their Role in Land Use Plans, Resources for the Future.

Banzhaf, H. S. and P. Jawahar (2005). Public Benefits of Undeveloped Lands on Urban Outskirts: Non-Market Valuation Studies and their Role in Land Use Plans, Resources for the Future.

Bark, R. H., D. E. Osgood, et al. (2009). "Habitat preservation and restoration: Do homebuyers have preferences for quality habitat?" Ecological Economics **68**: 1465-1475.

Bark, R. H., D. E. Osgood, et al. (2009). "Habitat preservation and restoration: Do homebuyers have preferences for quality habitat?" Ecological Economics **68**: 1465-1475.

Bates and L. (2001). "The Public Demand for Open Space: The Case of Connecticut Communities." Journal of Urban Economics **50**(1): 97-111.

Bates and L. (2001). "The Public Demand for Open Space: The Case of Connecticut Communities." Journal of Urban Economics **50**(1): 97-111.

Batstone, C., M. Stewart-Carbines, et al. (2010). Understanding values associated with stormwater remediation options in marine coastal ecosystems: A case study from Auckland, New Zealand, Adelaide.

> This paper describes the design and implementation of a choice experiment to understand Aucklanders' preferences for environmental qualities associated with the effects of urban run-off on marine coastal environments. Auckland's coastal environments are affected by a range of ecological and human factors. While much research has been undertaken in the area of ecology, little is understood of human preferences for coastal environments and their management. An unlabelled choice experiment was developed with three environmental quality attributes specified at three broad coastal categories. The environmental qualities are ecological health, water clarity, and underfoot conditions. Willingness to pay estimates for these attributes indicates that respondents show a strong preference for improved environmental quality at outer coastal beach locations over middle and upper harbour locations. Water quality leads ecological health, then underfoot conditions in importance at beach locations. An application is discussed in which a hypothetical project consisting of policy and engineering components delivers changes in water quality and underfoot conditions in the Auckland upper harbour areas. A 95% confidence estimate of the money value of that change ranges from $ 783 m. to $ 1,122 b. The key outcome is

demonstration of the choice experiment as a statistically robust and flexible approach to making sense of Aucklanders' complex preferences for coastal ecosystem management.

Been, V. and I. Voicu (2008). "The effect of community gardens on neighboring property values." Real Estate Economics **36**: 241-283.

Been, V. and I. Voicu (2008). "The effect of community gardens on neighboring property values." Real Estate Economics **36**: 241-283.

Bennett, L. L., G. Acharya, et al. (1998). Valuing Open Space and Land Use Chaos in Urban Watersheds: An Hedonic Property Value Analysis (Draft). World Congress of Environmental and Resource Economists. Venice.

Bergstrom, J. C. and L. O. Taylor (2006). "Using meta-analysis for benefits transfer: Theory and practice." Ecological Economics **60**(2): 351-360.

Bin, O., C. E. Landry, et al. (2008). Riparian Buffers and Hedonic Prices: A Quasi-Experimental Analysis of Residential Property Values in the Neuse River Basin, East Carolina University Working Paper.

Riparian buffers, the strips of vegetation along banks of rivers and streams, have been proposed as a key instrument to protect water quality in the U.S. Riparian buffers impose a restriction on the use of private property limiting harvest and development, but buffers can also provide for aesthetic and recreational benefits that may accrue to property owners. With data from the Neuse River Basin in North Carolina, this study attempts to provide empirical evidence on the effect of a mandatory buffer rule on the value of riparian properties. Spatial autoregressive hedonic models are estimated within a quasi-experimental framework using the imposition of the buffer rule as the treatment and non-riparian properties as a control group. Results indicate that riparian property generally commands a high premium. We find no evidence, however, that the mandatory buffer rule has had a significant impact on riparian property values when compared with the control group.

Bolitzer, B. and N. R. Netusil (2000). "The impact of open spaces on property values in Portland, Oregon." Journal of Environmental Management **59**: 185-193.

Bolitzer, B. and N. R. Netusil (2000). "The impact of open spaces on property values in Portland, Oregon." Journal of Environmental Management **59**: 185-193.

Bowman, T. and J. Thompson (2009). "Barriers to implementation of low-impact and conservation subdivision design: Developer perceptions and resident demand." Landscape and Urban Planning **92**: 96-105.

Bowman, T., J. Thompson, et al. (2009). "Valuation of open space and conservation features in residential subdivisions." Journal of Environmental Management **90**: 321-330.

Boyer, T. and S. Polasky (2004). "Valuing Urban Wetlands: A review of non-market valuation studies." Wetlands **24**(4): 744-755.

Braden, J. B. and D. M. Johnston (2004). "Downstream Economic Benefits from Storm-Water Management." Journal of Water Resources Planning & Management **130**(6): 498-505.

Breffle, W. S., E. R. Morey, et al. (1998). "Using Contingent Valuation to Estimate a Neighbourhood's Willingness to Pay to Preserve Undeveloped Urban Land." Urban Stud **35**(4): 715-727.

Contingent valuation (CV) is used to estimate a neighbourhood's willingness to pay (WTP) to preserve a 5.5-acre parcel of undeveloped land in Boulder, Colorado, that provides views, open space and wildlife habitat. Households were surveyed to determine bounds on their WTP for preservation. An interval model is developed to estimate sample WTP as a function of distance, income and other characteristics. The model accommodates individuals who might be made better off by development and addresses the accumulation of WTP responses at zero. Weighted sample WTP estimates are aggregated to obtain the neighbourhood's WTP. This application demonstrates that contingent valuation is a flexible policy tool for land managers and community groups wanting to estimate WTP to preserve undeveloped urban land.

Brown, P. J. and C. J. Fausold (1998). A Methodology for Valuing Town Conservation Land.

This paper presents a methodology for rating existing or potential conservation land according to ten criteria weighted to reflect the needs of the local community in which the land is located. The ratings may be used to determine priority for public acquisition. The methodology may also be used to establish a dollar "replacement value" for an existing parcel of conservation land, reflecting both its market value as well as its value for other public interests such as conservation, recreation, views, or resource protection. The replacement value may be used as a starting point in negotiations for compensation in the event that the parcel is removed from conservation land status through eminent domain or other mechanism.

Bullock, C. H. (2008). "Valuing urban green space: Hypothetical alternatives and the status quo." Journal of Environmental Planning and Management **51**: 15-35.

Cape Ann Economics Open Space Proximity and Land Values.

N/A

Casey, F., K. Bowden, et al. (2008). A Preliminary Assessment of the Economic Benefits of Land Conservation Areas in Florida.

The purpose of this paper is to provide a preliminary estimate of the economic benefits that are generated by those lands that have been acquired under the three Florida state conservation programs; Conservation and Recreations Lands (CARL), Preservation 2000 (P2000) and Florida Forever (FF). Between 1979 and 2006, the state of Florida acquired 3.8 million acres through these programs (Hodges 2006), making it the largest public land buying program in the United States. During the 1990-2000 decade, the state allocated $300 million annually to acquiring environmentally sensitive lands, wildlife habitat, water resource areas, recreation and cultural sites, landscape linkages, trails, city parks, state forests, beaches, and wildlife management areas. Since 1990, through the P2000 and FF programs, over 2 million acres of Florida's natural landscape has been preserved through fee simple acquisition, easements and matching funds.

Cavailhes, J., T. Brossard, et al. (2009). "GIS-Based Hedonic Pricing of Landscape." Environmental & Resource Economics **44**: 571-590.

Center for Neighborhood Technology (2009). National Green Values Calculator Methodology.

N/A

Cheshire, P. and S. Sheppard (1995). "On the Price of Land and the Value of Amenities." Economica **62**: 247-267.

Cheshire, P. and S. Sheppard (1995). "On the Price of Land and the Value of Amenities." Economica **62**: 247-267.

Cho, S. H., J. M. Bowker, et al. (2006). Measuring the Contribution of Water and Green Space Amenities to Housing Values: An Application and Comparison of Spatially-weighted Hedonic Models.

This study estimates the influence of proximity to water bodies and park amenities on residential housing values in Knox County, Tennessee, using the hedonic price approach. Values for proximity to water bodies and parks are first estimated globally with a standard ordinary least square (OLS) model. A locally weighted regression model is then employed to investigate spatial non-stationarity and generate local estimates for individual sources of each amenity. The local model is able to capture the variability in the quality of water bodies and parks across the county, something a conventional hedonic model using OLS cannot do.

Cho, S. H., J. M. Bowker, et al. (2006). Measuring the Contribution of Water and Green Space Amenities to Housing Values: An Application and Comparison of Spatially-weighted Hedonic Models. S.-H. Cho, J. M. Bowker and W. M. Park.

This study estimates the influence of proximity to water bodies and park amenities on residential housing values in Knox County, Tennessee, using the

hedonic price approach. Values for proximity to water bodies and parks are first estimated globally with a standard ordinary least square (OLS) model. A locally weighted regression model is then employed to investigate spatial non-stationarity and generate local estimates for individual sources of each amenity. The local model is able to capture the variability in the quality of water bodies and parks across the county, something a conventional hedonic model using OLS cannot do.

Cho, S. H., C. D. Clark, et al. (2009). "Spatial and Temporal Variation in the Housing Market Values of Lot Size and Open Space." Land Economics **85**: 51-73.

Cho, S. H., C. D. Clark, et al. (2009). "Spatial and Temporal Variation in the Housing Market Values of Lot Size and Open Space." Land Economics **85**: 51-73.

Cho, S. H., N. C. Poudyal, et al. (2008). "Spatial analysis of the amenity value of green open space." Ecological Economics **66**: 403-416.

Cho, S.-H. and R. K. Roberts (2007). "Cure for Urban Sprawl: Measuring the Ratio of Marginal Implicit Prices of Density-to-Lot-Size." Review of Agricultural Economics **29**(3): 572-579.

Cho, S.-H. and R. K. Roberts (2007). "Cure for Urban Sprawl: Measuring the Ratio of Marginal Implicit Prices of Density-to-Lot-Size." Review of Agricultural Economics **29**(3): 572-579.

City of Portland Bureau of Environmental Services (2008). Cost Benefit Evaluation of Ecoroofs. Portland, OR.

Colby, B. G. and S. Wishart (2002). "Quantifying the Influence of Desert Riparian Areas on Residential Property Values." The Appraisal Journal **July**.

Colby, B. G. and S. Wishart (2002). "Quantifying the Influence of Desert Riparian Areas on Residential Property Values." The Appraisal Journal **July**.

Colby, D. B. and S. Wishart (2002). Riparian Areas Generate Property Value Premium for Landowners, University of Arizona, Department of Agricultural and Resource Economics.

Colorado Department of Local Affairs Division of Local Government Census 2000 ACS 2005 Comparison Issues.

Crompton, J. L. (2001). "The Impact of Parks on Property Values: A Review of the Empirical Evidence." Journal of Leisure Research **33**(1): 1-31.

Crompton, J. L. (2001). "The Impact of Parks on Property Values: A Review of the Empirical Evidence." Journal of Leisure Research **33**(1): 1-31.

Crompton, J. L. (2005). The Impact of Parks and Open Space on Property Values and the Property Tax Base.

Crompton, J. L. (2005). The Impact of Parks and Open Space on Property Values and the Property Tax Base.

Crompton, J. L. and S. Nicholls (2006). "An Assessment of Tax Revenues Generated by Homes Proximate to a Greenway." Journal of Park and Recreation Administration **24**(3): 103-108.

Daniel, V. E., R. J. G. M. Florax, et al. (2009). "Flooding risk and housing values: An economic assessment of environmental hazard." Ecological Economics **69**(2): 355-365.

Defenders of Wildlife: Conservation Economics Program (2008). A Bibliography of Economic Valuation Literature.

N/A

DesRosiers, F., M. Theriault, et al. (2002). "Landscaping and House Values: An Empirical Investigation." JRER **23**.

This article is the winner of the Real Estate Valuation manuscript prize (sponsored by The Appraisal Institute) presented at the 2001 American Real Estate Society Annual Meeting. This hedonic study investigates the effect of landscaping on house values, based on a detailed field survey of 760 singlefamily homes sold between 1993 and 2000 on the territory of the Quebec Urban Community. Environmental information includes thirty-one landscaping attributes of both houses and their immediate environment. By and large, a positive tree cover differential between the property and its immediate neighborhood, provided it is not excessive, translates into a higher house value. Findings also suggest that the positive price impact of a good tree cover in the visible surroundings is all the more enhanced in areas with a high proportion of retired persons. Finally, a high percentage of lawn cover as well as features such as flower arrangements, rock plants, the presence of a hedge, etc. all command a substantial market premium.

Do, A. Q. and G. Grudnitski (1995). "Golf Courses and Residential House Prices: An Empirical Examination." Journal of Real Estate Finance and Economics **10**: 261-270.

Do, A. Q. and G. Grudnitski (1995). "Golf Courses and Residential House Prices: An Empirical Examination." Journal of Real Estate Finance and Economics **10**: 261-270.

Donjek, I. (2009). Fiscal and Economic Impact of Open Space.

N/A

Donovan, G. H. and D. T. Butry (2008). Market-Based Approaches to Tree Valuation. Arborist News.

recent four-part series in Arborist News outlined different appraisal processes used to value urban trees. The final article in the series described the three generally accepted approaches to tree valuation: the sales comparison approach, the cost approach, and the income capitalization approach. The author, D. Logan Nelson, noted that the sales comparison approach has the appeal of being based on observed market transactions. In this article, we outline the strengths and weaknesses of the sales comparison approach, define what type of value it estimates, and introduce the hedonic price method as an alternative, market-based method for valuing urban trees. We present results from a recent study in Portland, Oregon, that examined the value of street trees using the hedonic price method. The results from our study, although based on the Portland housing market, provide some broader insights into how trees affect house values.

Donovan, G. H. and D. T. Butry (2010). "Trees in the city: Valuing street trees in Portland, Oregon." Landscape and Urban Planning **94**(2): 77-83.

Doss, C. R. and S. J. Taff (1996). "The Influence of Wetland Type and Wetland Proximity on Residential Property Values." Journal of Agricultural and Resource Economics **21**(1): 120-129.

Using detailed residential housing and wetland location data, we determine relative preferences for proximity to four broad classes of wetlands, as expressed through housing values. Implicit prices for proximity to open-water and scrub-shrub wetlands are relatively higher than those for emergent-vegetation and forested wetlands.

Duke, J. M. and R. J. Johnston (2007). Multifunctionality and Land Use Policy: An Application of Nonmarket Valuation to Urban Fringe Farm and Forest Preservation.

This paper describes the results of a choice experiment which estimates willingness to pay for a large set of land-preservation amenities, including preservation policy attributes. Such amenities represent an important category of nonmarket outputs of multifunctional agriculture. Results suggest that preservation benefits are highest for lands at a high risk of development and for those that provide moderate levels of public access. Conservation easements dominate the use of fee simple purchase. Specific land uses, in contrast, are found to have little impact on benefits. The results suggest that preservation benefits can be large, but that they also vary widely and may be low or even negative for some types of preservation. Implications of model results and suggestions for developing prioritization strategies for land preservation are discussed.

Earnhart, D. (2001). "Combining Revealed and Stated Preference Methods to Value Environmental Amenities at Residential Locations." Land Economics **77**(1): 12-29.

Embrace Open Space (2009). Hennepin County Economic Analysis - Executive Summary.

Embrace Open Space commissioned an economic study of home values in Hennepin County to quantify the financial impact of proximity to open spaces on the value of nearby single-family homes. As communities in the Twin Cities metropolitan area begin to plan now for one million new residents coming to the region by 2030, such results can help communities better understand how decisions to conserve open space might affect property tax revenues.

Espey, M. and K. Owusu-Edusei (2001). "Neighborhood Parks and Residential Property Values in Greenville, South Carolina." Journal of Agricultural and Applied Economics **33**(3): 487-492.

Fausold, C. J. and R. J. Lilieholm (1996). The Economic Value of Open Space: A Review and Synthesis, Lincoln Institute of Land Policy Research Paper.

This paper reviews several approaches for measuring and expressing the economic value of open space, and summarizes examples of each from published reports and research findings. Included are fiscal impact studies, market and enhancement value, natural system value, use and nonuse value, production value, the revenue generated by open space-related activities, and various intangible values. These values are not universally present within a given community, nor are they quantitatively additive. However, a comprehensive consideration of the multiple values of open space will better inform community decisions about land conservation and development.

Geoghegan, J. (2002). "The value of open spaces in residential land use." Land Use Policy **19**: 91-98.

Geoghegan, J. (2002). "The value of open spaces in residential land use." Land Use Policy **19**: 91-98.

Geoghegan, J., L. A. Wainger, et al. (1997). "Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS." Ecological Economics **23**: 251-264.

Geoghegan, J., L. A. Wainger, et al. (1997). "Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS." Ecological Economics **23**: 251-264.

Gies, E. and T. T. f. P. Land (2009). Conservation: An Investment That Pays: The Economic Benefits of Parks and Open Space.

More than 20 years ago, The Trust for Public Land started collecting references and research on the economic benefits of creating parks and conserving natural lands. Conservation: An Investment That Pays is the third publication in what has become one of the most downloaded series of offerings on TPL's website. Our goal has been to provide conservation advocates with tools to make the case for conservation as a wise use of the public dollar—an investment rather than a cost. This paper also is one of a series of white papers on the many and interrelated

benefits that parks and conserved lands bring to communities. Other papers in the series include The Benefits of Parks and The Health Benefits of Parks. All TPL publications on the benefits of parks and open space, including economic benefits, are available in the Research section of www.tpl.org. Information about the economic benefits of parks and open space has burgeoned over the last 20 years. Hardly a week goes by without the appearance of a new academic study or news story illustrating these benefits. It is now widely understood that parks, greenways, and natural lands can boost property values, attract and support businesses, save energy and water-treatment costs, and safeguard the natural systems on which our economic well-being depends. In addition to more information, we have better information about the economic benefits of parks and open space. Research, including that sponsored by TPL's own Center for Conservation Finance and Center for City Park Excellence, has focused on new ways of putting dollar values on the many benefits parks and natural lands bring to communities—including benefits that were not even considered two decades ago, such as the sequestration of carbon to mitigate costly climate change. It is not the intent of this paper to provide an analysis of how the economic benefits of parks and open space are measured. And given the proliferation of studies and news items touching on this topic, we cannot claim that this is an exhaustive treatment of the topic. But we have tried to collect and put into context the most pertinent recent studies and news items on the topic, along with citations of the sources so that curious readers can explore further. TPL is releasing this white paper in the midst of a worldwide economic downturn. In such times, it is especially important that conservationists and park advocates be able to make the case that parks and open space are not amenities but important investments in community well-being—including economic well-being. We hope that the examples and research cited in this paper will help.

Hardie, I., E. Lichtenberg, et al. (2007). "Regulation, open space, and the value of land undergoing residential subdivision." Land Economics **83**: 458-474.

Hardie, I., E. Lichtenberg, et al. (2007). "Regulation, open space, and the value of land undergoing residential subdivision." Land Economics **83**: 458-474.

Heaney, J. P., D. Sample, et al. (2002). Costs of Urban Stormwater Control, U.S. EPA - National Risk Management Library.

Heintzelman, M. A. (2010). "Measuring the Property-Value Effects of Local Land Use and Preservation Referenda." Land Economics **86**: 22-47.

Helfand, G., J. Sikpark, et al. (2006). "The economics of native plants in residential landscape designs." Landscape and Urban Planning **78**(3): 229-240.

Hill, E. S., S. Pugh, et al. (2007). Use of the Hedonic Method to Estimate Lake Sedimentation Impacts on Property Values in Mountain Park and Roswell, GA, Portland, OR.

Hitzhusen, F. J., N. Yen, et al. (2007). Willingness to Pay for LID Environmental Benefits, ASCE.

Hobden, D. W., G. E. Laughton, et al. (2004). "Green space borders--a tangible benefit? Evidence from four neighbourhoods in Surrey, British Columbia, 1980-2001." Land Use Policy **21**(2): 129-138.

Horner, R. R. Investigation of the Feasibility and Benefits of Low Impact Site Design Practices ("LID") for the San Diego Region.

Huber, M. C., D. B. Willis, et al. (2010). Incentive Policies to Promote the Use of Enhanced Stormwater BMPs in New Residential Developments, Orlando, FL.

> Incentive based environmental policies offer opportunities to reduce the effects of stormwater runoff in residential areas. An incentive compatible Stormwater Banking Program (SBP) is presented that allows the developer to build at a greater residential density in exchange for paying a portion of their participation profits as a participation fee to the SBP and installing stormwater low impact BMPs. In addition to increased developer profit, the SBP achieves stormwater runoff control well above the minimum regulatory requirement on new developments and gains additional revenue that can be used to retrofit outdated and/or poorly functioning BMPs in existing developments to enhance regional stormwater management.

Hughes, W. T., Jr. and G. K. Turnbull (1996). "Uncertain Neighborhood Effects and Restrictive Covenants." Journal of Urban Economics **39**: 160-172.

Hughes, W. T., Jr. and G. K. Turnbull (1996). "Uncertain Neighborhood Effects and Restrictive Covenants." Journal of Urban Economics **39**: 160-172.

Ichihara, K. and J. P. Cohen "New York City Property Values: What is the Impact of Green Roofs on Pricing?" unpublished as of 7/12/10.

Irwin, E. G. (2002). "The effects of open space on residential property values." Land Economics **78**: 465-480.

Irwin, E. G. (2002). "The Effects of Open Space on Residential Property Values." Land Economics **78**(4): 465.

> The marginal values of different open space attributes are tested using a hedonic pricing model with residential sales data from central Maryland. The identification problems that arise due to endogenous land use spillovers and unobserved spatial correlation are addressed using instrumental variables estimation with a randomly drawn subset of the data that omits nearest neighbors. Results show a premium associated with permanently preserved open space relative to developable agricultural and forested lands and support the hypothesis that open space is most valued for providing an absence of development, rather than for

providing a particular bundle of open space amenities. [ABSTRACT FROM AUTHOR]

Irwin, E. G. and N. E. Bockstael (2001). "The problem of identifying land use spillovers: Measuring the effects of open space on residential property values." American Journal of Agricultural Economics **83**: 698-704.

Irwin, E. G. and N. E. Bockstael (2001). "The problem of identifying land use spillovers: Measuring the effects of open space on residential property values." American Journal of Agricultural Economics **83**: 698-704.

Jacob, J. S. and R. Lopez (2009). "Is Denser Greener? An Evaluation of Higher Density Development as an Urban Stormwater-Quality Best Management Practice." Journal of the American Water Resources Association **45**(3): 687-701.

Jaeger, W. K. (2006). "The Effects of Land-Use Regulations on Property Values." Environmental Law **36**: 105-130.

Jim, C. Y. and W. Y. Chen "External effects of neighbourhood parks and landscape elements on high-rise residential value." Land Use Policy **27**: 662-670.

Johnston, D. M., J. B. Braden, et al. (2006). "Downstream Economic Benefits of Conservation Development." Journal of Water Resources Planning & Management **132**(1): 35-43.

Johnston, R. J., S. K. Swallow, et al. (2002). "Spatial Factors and Stated Preference Values for Public Goods: Considerations for Rural Land Use." Land Economics **78**(4): 481-500.

Kalman, O., J. R. Lund, et al. (2000). "Benefit-Cost Analysis of StormwaterQuality Improvements." Environmental Management **26**(6): 615-628.

Kaplan, R., M. E. Austin, et al. (2004). "Open Space Communities: Resident Perceptions, Nature Benefits, and Problems with Terminology." Journal of the American Planning Association **70**(No. 3).

N/A

Kaufman, D. and N. Cloutier (2006). "The Impact of Small Brownfields and Greenspaces on Residential Property Values." Journal of Real Estate Finance & Economics **33**(1): 19-30.

Using a hedonic pricing model, this paper investigates the responsiveness of residential property values in a well-defined inner-city neighborhood of Kenosha, Wisconsin, to the presence of two small former industrial sites contaminated by various environmental pollutants, or brownfields, and a local neighborhood park, or greenspace. Using readily available data on sales and assessments for residential property in close proximity to the brownfields and the greenspace, we estimate well-behaved and statistically significant property value gradients with respect to the park, the environmental amenity, and the brownfields, the environmental disamenities. These functions are then used to estimate the possible impact that brownfield remediation may have on total property value. We estimate that remediation and redevelopment of the brownfields into greenspaces would increase property values for the 890 neighborhood residences between $2.40 and $7.01 million. These results suggest that small brownfields have a measurable impact on property values and that readily accessible data can be used to help local policymakers make decisions on remediation issues. [ABSTRACT FROM AUTHOR]

Kaufman, D. and N. Cloutier (2006). "The Impact of Small Brownfields and Greenspaces on Residential Property Values." Journal of Real Estate Finance & Economics **33**(1): 19-30.

Using a hedonic pricing model, this paper investigates the responsiveness of residential property values in a well-defined inner-city neighborhood of Kenosha, Wisconsin, to the presence of two small former industrial sites contaminated by various environmental pollutants, or brownfields, and a local neighborhood park, or greenspace. Using readily available data on sales and assessments for residential property in close proximity to the brownfields and the greenspace, we estimate well-behaved and statistically significant property value gradients with respect to the park, the environmental amenity, and the brownfields, the environmental disamenities. These functions are then used to estimate the possible impact that brownfield remediation may have on total property value. We estimate that remediation and redevelopment of the brownfields into greenspaces would increase property values for the 890 neighborhood residences between $2.40 and $7.01 million. These results suggest that small brownfields have a measurable impact on property values and that readily accessible data can be used to help local policymakers make decisions on remediation issues. [ABSTRACT FROM AUTHOR]

Kearney, A. R. (2006). "Residential development patterns and neighborhood satisfaction - Impacts of density and nearby nature." Environment and Behavior **38**: 112-139.

Kloss, C. and C. Calarusse (2006). Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows, Natural Resources Defense Council.

Kopits, E., V. McConnell, et al. (2007). "The trade-off between private lots and public open space in subdivisions at the urban-rural fringe." American Journal of Agricultural Economics **89**: 1191-1197.

Kroeger, T. (2008). Open Space Property Value Premium Analysis. Washington, D.C., National Council for Science and the Environment, 2006 Wildlife Habitat Policy Research Program.

Kroeger, T., J. Loomis, et al. (2008). Final Project Completion Report: WHPRP 2006 Project Topic 1H: "Development of an Operational benefits Estimation Tool for the U.S.".

We review the literature on the economic values provided by undeveloped lands. We conduct meta-analyses of the available studies to construct a spreadsheet-based “Benefits Estimation Toolkit” - a set of valuation and visitation models, value tables and databases. This Toolkit allows users to generate comprehensive estimates of the economic values associated with many conservation-oriented uses of undeveloped lands. Specifically, users can employ the Toolkit to estimate the dollar values of the benefits generated by a particular undeveloped area. The quantified benefits comprise open space property value premiums received by properties located near undeveloped lands; benefits to participants in wildlife-associated recreation activities; benefits associated with the conservation of threatened, endangered or rare species; and ecosystem services provided by terrestrial habitats, wetlands and aquatic habitat improvements. We also use available data on National Wildlife Refuge visitation and state-level participation in wildlife-associated recreation activities to construct two sets of models that allow users to estimate the number of wildlife-associated activity days an existing or proposed conservation area generates per year, or the additional days that would result from the expansion of an existing area. We provide detailed user manuals for the application of the models, tables and databases. Our review and synthesis of the open space premium literature supports the robust conclusion that open space, especially protected open

space, increases residential property values compared to the baseline, represented by the full development/no open space scenario. These premiums increase with increasing scarcity of open space but are also clearly present in less-developed areas. Our meta-analysis of the literature – the first such attempt – yields a statistically significant open space premium estimation model that explains almost 60 percent of the observed variation in open space premiums. It identifies size, protection status and ownership as significant factors for the size of open space premiums. While all open spaces generate price premiums, this premium is highest for forest cover and natural areas and lowest for agricultural areas. We also review the literature on the impacts of natural amenities on county or state-level income and output, employment, population, and per-capita income. The empirical studies employ both statistical modeling and survey approaches to analyze the impact of natural amenities. Their results clearly support the hypothesis that amenities positively impact output, employment and population growth and aggregate output in rural areas. In particular, limiting our analysis to studies that assess the impact of protected lands and excluding those that employ broader amenity measures such as climate, topography or man-made recreation facilities, none of the studies revealed a negative association between protected lands and income, output, employment or population. While several studies did not detect a significant impact of protected lands, the large majority reported significant positive impacts. By contrast, the evidence on the impact of protected lands on per-capita income is mixed, with studies revealing a negative, positive or no association at all. We construct a database of the existing studies that indicates the type and size of the impact analyzed in a particular study, the study area and method, the time period covered, the type of amenity measure used and the main characteristics of the amenity.

Kryvobokov, M. (2007). "What location attributes are the most important for market value? Extraction of attributes from regression models." Emerald **25**(No 3): 257-286.

Purpose – The purpose of this paper is to extract the location attributes, which are the most important for market value of real estate in countries with well-developed markets. Design/methodology/approach – In this paper meta-analysis is applied for extraction of location attributes and the weights of their importance. The outcomes of existing regression models created in different countries mainly with a developed real estate market are used. A total of 81 models described in 39 sources are analysed. Findings – The paper finds that the lists of statistically significant location attributes, which influence market value, are obtained for different real estate types. The weights of attributes' relative influence are compared, where possible. Research limitations/implications – In the paper meta-analysis is also applied for a limited number of empirical studies. However, for land and residential real estate the number of sources is sufficient to make a substantiated conclusion. The application of the outlined location attributes is a subject for future research. Practical implications – The paper shows that the lists of important location attributes can be used for practical specification of the valuation models for urban land and other real estate in countries where the market is underdeveloped, to increase the degree of objectivity and market

orientation. Originality/value – The paper is one of the few studies which synthesize the findings of existing regression models with respect to location attributes generally. The method of weights' estimation is original. The result of the paper has practical value for real estate valuation in countries with an underdeveloped market. Keywords Land, Assessment, Regression analysis Paper type Research paper

Lake, M. B. and K. W. Easter (2002). Hedonic Valuation of Proximity to Natural Areas and Farmland in Dakota County, Minnesota. **Staff Paper P02-12**.

Lake, M. B. and K. W. Easter (2002). Hedonic Valuation of Proximity to Natural Areas and Farmland in Dakota County, Minnesota. **Staff Paper P02-12**.

Land, T. T. f. P. (2007). The Economic Benefits of Land Conservation.
Does land conservation protect the bottom line? Leading experts in the field assert that it does. This book presents their quantitative and authoritative research on the economic benefits of land conservation. It brings together for the first time scientists, economists, and researchers from all sectors—academia, government, nonprofits, and industry—to summarize the best current studies, to present new original research, and to suggest areas for further inquiry into the economic benefits of land conservation. This book grew out of the success of The Trust for Public Land's (TPL) 1999 report, The Economic Benefits of Parks and Open Spaces, which offered case studies of how land conservation has helped communities grow smart, attract investment, revitalize cities, boost tourism, protect farms and ranches, prevent flood damage, and safeguard the environment. Eight years later, the report is still the number one downloaded item from our website, as elected officials and citizens demand information on land conservation as a sound investment strategy. In Chapter 1, John Crompton illustrates that parks and open space generate increased property tax revenue and yield a better return on investment than development. In Chapter 2, Lori Lynch reviews the economic benefits of farmland preservation, including maintaining viable local economies and protecting rural and environmental amenities. In Chapter 3, Caryn Ernst, Richard Gullick, and Kirk Nixon find that forest cover decreases the cost of treating drinking water. In Chapter 4, David Nowak, Jun Wang, and Ted Endreny enumerate the economic value of urban trees, which improve air and water quality. In Chapter 5, John Crompton examines the role of parks and open space in attracting businesses and affluent retirees. In sum, the contributors to this book demonstrate that a strategy of land conservation is integral to economic health, from maintaining parks and open space to preserving farmland to protecting urban trees and forests around drinking water sources. TPL gratefully acknowledges the Surdna Foundation, without whose generous financial support this book would not have been possible. I would also like to recognize and thank the following for their invaluable contributions to this project: Ernest Cook, Karen Foster, Kelley Hart, Brian Lehman, JeremyMorgan, AmyMullen, Janet Pawlukiewicz, Edith Pepper, Matthew Shaffer, Debra Summers, David Sweet, and Matt Zieper.

Lansford, N. H., Jr. and L. L. Jones (1995). "Marginal Price of Lake Recreation and Aesthetics: An Hedonic Approach." Journal of Agricultural and Applied Economics **27**(1): 212-223.

Lansford, N. H., Jr. and L. L. Jones (1995). "Marginal Price of Lake Recreation and Aesthetics: An Hedonic Approach." Journal of Agricultural and Applied Economics **27**(1): 212-223.

Lee, J. S. and M. H. Li (2009). "The impact of detention basin design on residential property value: Case studies using GIS in the hedonic price modeling." Landscape and Urban Planning **89**: 7-16.

Lee, J. S. and M. H. Li (2009). "The impact of detention basin design on residential property value: Case studies using GIS in the hedonic price modeling." Landscape and Urban Planning **89**: 7-16.

Lichtenberg, E. and I. Hardie (2007). "Open Space, Forest Conservation, and Urban Sprawl in Maryland Suburban Subdivisions." American Journal of Agricultural Economics **89**(5): 1198-1204.

Lindsey, G. and G. Knapp (1999). "Willingness to Pay for Urban Greenway Projects." Journal of the American Planning Association **65**(3): 297-313.

Lorenzo, A. B., C. A. Blanche, et al. (2000). "Assessing Residents' Willingness to Pay to Preserve the Community Urban Forest: A Small-city case study." Journal of Arboriculture **26**(6).

Abstract. Residents' willingness to pay for community urban forest preservation was assessed using a survey questionnaire mailed to 3,009 households in the city of Mandeville, a suburb of New Orleans, Louisiana, United States. Survey responses indicated the following: 1) residents' willingness to pay for urban forest protection and preservation is positively associated with their perceptions of the benefits of trees but negatively associated with their perceptions of the annoying features of trees; 2) the willingness to pay a higher premium (>$12) for tree preservation and protection is directly related to income levels; 3) more female than male respondents are willing to pay $6 to $12 per year for tree preservation but more male than female respondents are willing to pay more than $12 per year for tree preservation; 4) age, level of education, and type of residential ownership are not significantly associated with willingness to pay for tree preservation and protection; 5) more than 80% of respondents view the protection and preservation of urban trees as very important functions of the city and are willing to pay additional taxes for tree protection and preservation; and 6) more than 88% of respondents rate the city's overall performance in tree protection and maintenance as good to excellent. The survey results may find utility in crafting more effective support programs for urban tree protection and

preservation. Key Words. Urban tree benefits; urban tree annoyances; socioeconomic variables.

Luttik, J. (2000). "The value of trees, water and open space as reflected by house prices in the Netherlands." Landscape and Urban Planning **48**: 161-167.

An attractive environment is likely to influence house prices. Houses in attractive settings will have an added value over similar, less favourably located houses. This effect is intuitively felt, but does it always occur? Which environmental factors make a location an attractive place to live in? The present study explored the effect of different environmental factors on house prices. The research method was the hedonic pricing method, which uses statistical analysis to estimate that part of a price due to a particular attribute. Nearly 3000 house transactions, in eight towns or regions in the Netherlands, were studied to estimate the effect of environmental attributes on transaction prices. Some of the most salient results were as follows. We found the largest increases in house prices due to environmental factors (up to 28%) for houses with a garden facing water, which is connected to a sizeable lake. We were also able to demonstrate that a pleasant view can lead to a considerable increase in house price, particularly if the house overlooks water (8±10%) or open space (6±12%). In addition, the analysis revealed that house price varies by landscape type. Attractive landscape types were shown to attract a premium of 5±12% over less attractive environmental settings. # 2000 Elsevier Science B.V. All rights reserved. Keywords: Economic valuation; Trees; Water; Open space; House prices

Lutzenhiser, M. and N. R. Netusil (2001). "The Effect of Open Spaces on a Home's Sale Price." Contemporary Economic Policy **19**(3): 291-298.

The relationship between a home's sale price and its proximity to different open spaces types is explored using a data set comprised of single-family home sales in the city of Portland, within Multnomah County, between 1990 and 1992. Homes located within 1,500 feet of a natural area park, where more than 50% of the park is preserved in native and/or natural vegetation, are found to experience, on average, the largest increase in sale price. The open space size that maximizes a home's sale price is calculated for each open space type. Natural area parks require the largest acreage to maximize sale price, and specialty parks are found to have the largest potential effect on a home's sale price. A zonal approach is used to examine the relationship between a home's sale price and its distance to an open space. Natural area parks and specialty parks are found to have a positive and statistically significant effect on a home's sale price for each zone studied. Homes located adjacent to golf courses (within 200 feet) are estimated to experience the largest increase in sale price due to open space proximity although the effect drops off quickly as distance from the golf course increases.

MacMullan, E. (2007). Assessing Low Impact Developments Using a Benefit-Cost Approach.

N/A

MacMullan, E. (2008). The Economics of LID (Slide presentation), ECONorthwest.
N/A

MacMullan, E. (2009). Using Incentives to Promote Green Stormwater Practices.

MacMullan, E. and S. Reich (2009). Low Impact Development At The Local Level: Developers' Experiences and City and County Support, ECONorthwest.
N/A

Mahan, B. L., P. Polasky, et al. (2000). "Valuing Urban Wetlands: A property price approach." Land Economics **76**(1): 100-113.
This study estimates the value of wetland amenities in the Portland, Oregon, metropolitan area using the hedonic property price model. Residential housing and wetland data are used to relate the sales price of a property to structural characteristics, neighborhood attributes, and amenities of wetlands and other environmental characteristics. Measures of interest are distance to and size of wetlands, including distancet of our different wetland types; open water, emergent vegetation, scrub-shrub, and forested. Other environmental variables include proximity to parks,lakes, streams, and rivers. Results indicate that wetlands influence the value of residential property and that wetlands influence property values differently than other amenities. Increasing the size of the nearest wetland to a residence by one acre increased the residence's value by $24. Similarly, reducing the distance to the nearest wetland by 1,000 feet increased the value by $436. Home values were not influenced by wetland type.

Mahan, B. L., S. Polasky, et al. (2000). "Valuing Urban Wetlands: A Property Price Approach." Land Economics **76**(1): 100-113.
This study estimates the value of wetland amenities in the Portland, Oregon, metropolitan area using the hedonic property price model. Residential housing and wetland data are used to relate the sales price of a property to structural characteristics, neighborhood attributes, and amenities of wetlands and other environmental characteristics. Measures of interest are distance to and size of wetlands, including distance to four different wetland types; open water, emergent vegetation, scrub-shrub, and forested. Other environmental variables include proximity to parks, lakes, streams, and rivers. Results indicate that wetlands influence the value of residential property and that wetlands influence property values differently than other amenities. Increasing the size of the nearest wetland to a residence by one acre increased the residence's value by $24. Similarly, reducing the distance to the nearest wetland by 1,000 feet increased the value by $436. Home values were not influenced by wetland type.

Mansfield, C., S. K. Pattanayak, et al. (2002). "Shades of Green: Measuring the value of urban forests in the housing market." Journal of Forest Economics **11**: 177-199.

Martin, R. and T. Carter (2009). Impact of Endangered Species Act Standards on Vacant Land Prices in Cherokee County, Georgia, ETOWAH.

The spatial growth of urban areas is associated with a large number of actual and potential problems. These problems include such things as increased traffic congestion, overburdened public infrastructure, and decreased access to employment opportunities for lower-skilled central city residents. Additionally, since much of the new development that is spawned by the expansion of urban areas into previously rural ones occurs in undeveloped areas, there are a host of environmental concerns associated with such growth such as habitat destruction and air quality impacts. One area of particular concern is the impact of increased levels of development on the quality of streams and rivers. Studies have documented an effect on both the biotic and abiotic components of the aquatic ecosystem in relationship to urban land cover (e.g. Helms et al, 2009; Schoonover et al, 2006; Wickham et al, 2008). Researchers have collectively classified the urban effect on streams as the "urban stream syndrome," having "symptoms" of flashier hydrographs, higher pollutant levels, highly modified channel geomorphology and decreased biotic richness than its non-urban counterparts (Walsh et al, 2005). In response to these urban threats to river and stream quality, state and local governments have sought policy approaches that can preserve river and stream quality while not stifling the ability of newly developing areas to benefit from growth. This can be a delicate balancing act, as regulations that are too stringent or lead to excessively long approval periods can make it difficult for supply to keep up with demand and lead to decreased housing affordability. Several recent studies in urban economics have linked reduced housing affordability with high levels of growth controls (Quigley and Raphael, 2005, Glaeser et al, 2005). At the same time, however, regulations that are too lenient run the risk of allowing new development to negatively impact local environments such as aquatic ecosystems. This study looks at one particular set of development standards in Cherokee County, Georgia, that have as their primary focus the protection of endangered fish species. The goal is to determine whether the standards impact vacant land values, and, if so, in what direction. The rest of the paper is organized as follows. The next section profiles Cherokee County and the set of policy approaches employed in the county. The following section outlines the data used in the study and provides a summary of the data. Section IV explains the empirical approach employed in the study, and is followed by a section that presents the study's results. Finally, a concluding section summarizes our findings and suggests areas for future research.

Martins-Filho, C. and O. Bin (2005). "Estimation of hedonic price functions via additive nonparametric regression." Empirical Economics **30**(1): 93-114.

We model a hedonic price function for housing as an additive nonparametric regression. Estimation is done via a backfitting procedure in combination with a local polynomial estimator. It avoids the pitfalls of an unrestricted nonparametric estimator, such as slow convergence rates and the curse of dimensionality. Bandwidths are chosen using a novel plug in method that minimizes the asymptotic mean average squared error (AMASE) of the regression. We

compare our results to alternative parametric models and find evidence of the superiority of our nonparametric model. From an empirical perspective our study is interesting in that the effects on housing prices of a series of environmental characteristics are modeled in the regression. We find these characteristics to be important in the determination of housing prices. [ABSTRACT FROM AUTHOR]

McConnell, V. and M. Walls (2005). The Value of Open Space: Evidence from Studies of Nonmarket Benefits, Resources for the Future.
N/A

McPherson, E. G. (1992). "Accounting for Benefits and Costs of Urban Greenspace." Landscape and Urban Planning **22**: 41-51.

McPherson, E. G., J. R. Simpson, et al. (2006). Piedmont Community Tree Guide: Benefits, Costs, and Strategic Planting, USDA Forest Service, Pacific Southwest Research Station.
N/A

Mikelbank, B. M. and C. f. H. P. Research (2006). Hedonic Analysis of Riparian/ Wetland Setbacks, Prepared for Chagrin River Watershed Partners, Inc. Cleveland, Cleveland State University, Maxine Goodman Levin College of Urban Affairs.

Mogush, P., K. J. Krizek, et al. (2005). Value of Trail Access on Home Purchases. 84th Annual Meeting of Transportation Research Board. Washington, DC.

Mogush, P., K. J. Krizek, et al. (2005). Value of Trail Access on Home Purchases. 84th Annual Meeting of Transportation Research Board. Washington, DC.

Mohamed, R. (2006). "The economics of conservation subdivisions - Price premiums, improvement costs, and absorption." Urban Affairs Review **41**: 376-399.

Mooney, S. and L. M. Eisgruber (2001). "The influence of riparian protection measures on residential property values: The case of the oregon plan for salmon and watersheds." Journal of Real Estate Finance and Economics.

Moore, R. L., A. R. Graefe, et al. (1992). The Impacts of Rail-Trails: A study of the users and property owners from three trails.

Moore, R. L., A. R. Graefe, et al. (1992). The Impacts of Rail-Trails: A study of the users and property owners from three trails.

Morrow-Jones, H. A., E. G. Irwin, et al. (2004). "Consumer preference for neotraditional neighborhood characteristics." Housing Policy Debate **15**: 171-202.

Moscovitch, E. (2007). The Economic Impact of Proximity to Open Space on Single-Family Home Values in Washington County, Minnesota, Embrace Open Space.
N/A

Munroe, D. K. (2007). "Exploring the determinants of spatial pattern in residential land markets: amenities and disamenities in Charlotte, NC, USA." Environment and Planning B-Planning & Design **34**: 336-354.

Nassauer, J. (1992). "The appearance of ecological systems as a matter of policy." Landscape Ecology **6**(4): 239-250.

Nassauer, J. (2004). "MONITORING THE SUCCESS OF METROPOLITAN WETLAND RESTORATIONS: CULTURAL SUSTAINABILITY AND ECOLOGICAL FUNCTION." WETLANDS **24**(4): 756–765.

Nassauer, J., J. D. Allan, et al. (2004). "Exurban residential subdivision development: Effects on water quality and public perception." Urban Ecosystems **7**: 267–281.

Nassauer, J. I., Z. Wang, et al. (2009). "What will the neighbors think? Cultural norms and ecological design." Landscape and Urban Planning **92**(3-4): 282-292.

Natural Resources Defense Council (1999). "Stormwater Strategies - Chapter 3." from http://www.nrdc.org/water/pollution/storm/chap3.asp.

Natural Resources Defense Council (1999). "Stormwater Strategies - Chapter 5." from http://www.nrdc.org/water/pollution/storm/chap5.asp.

Natural Resources Defense Council (1999). "Stormwater Strategies: Community Responses to Runoff Pollution." from http://www.nrdc.org/water/pollution/storm/stoinx.asp.

Netusil, N. R. (2005). "The Effect of Environmental Zoning and Amenities on Property Values: Portland, Oregon." Land Economics **81**(2): 227-246.
This study uses the hedonic-price-method to examine how environmental zoning and amenities are related to the price of single-family residential properties sold between 1999 and 2001 in Portland, Oregon. The impact of environmental zoning is found to vary with the type of environmental zoning and the property's location. Amenities are found to influence a property's sale price with the effect varying by amenity type and proximity. The net effect on a property's sales price is dependent on the type of environmental zoning, location in the study area,

amenities on the property, and amenities in the surrounding neighborhood. (JEL R14, R52)

Netusil, N. R. (2006). "Economic Valuation of Riparian Corridors and Upland Wildlife Habitat in an Urban Watershed." Journal of Contemporary Water Research & Education(134): 39-45.

N/A

Netusil, N. R. (2006). "Economic Valuation of Riparian Corridors and Upland Wildlife Habitat in an Urban Watershed." Journal of Contemporary Water Research & Education(134): 39-45.

N/A

Netusil, N. R., S. Chattopadhyay, et al. (2010). "Estimating the Demand for Tree Canopy: A Second-Stage Hedonic Price Analysis in Portland, Oregon." Land Economics **86**(2): 281-293.

The benefits of large patches of tree canopy are estimated by applying a hedonic price model to the sale of single-family residential properties in Portland, Oregon. The first-stage analysis provides evidence of diminishing returns from increasing tree canopy past a certain level. The second-stage analysis uses a survey of property owners' preferences and socioeconomic characteristics to overcome the problem of endogeneity. Average benefit estimates for the mean canopy cover within [1/4] mile of properties in the study area, using the second-stage model, are between 0.75% and 2.52% of the mean sale price. (JEL Q21, Q51)

Netusil, N. R., S. Chattopadhyay, et al. (2010). "Estimating the Demand for Tree Canopy: A Second-Stage Hedonic Price Analysis in Portland, Oregon." Land Economics **86**(2): 281-293.

The benefits of large patches of tree canopy are estimated by applying a hedonic price model to the sale of single-family residential properties in Portland, Oregon. The first-stage analysis provides evidence of diminishing returns from increasing tree canopy past a certain level. The second-stage analysis uses a survey of property owners' preferences and socioeconomic characteristics to overcome the problem of endogeneity. Average benefit estimates for the mean canopy cover within [1/4] mile of properties in the study area, using the second-stage model, are between 0.75% and 2.52% of the mean sale price. (JEL Q21, Q51)

Nicholls, S. Measuring the impact of parks on property values: new research shows that green spaces increase the value of nearby housing. BNET.com.

Nicholls, S. (2004). Measuring the impact of parks on property values: new research shows that green spaces increase the value of nearby housing. BNET.com.

Nicholls, S. and J. L. Crompton (2005). "The Impact of Greenways on Property Values: Evidence from Austin, Texas." Journal of Leisure Research **37**(3): 321-341.

The effect of greenways on surrounding residential property values remains somewhat of an unknown quantity. Though several studies have ascertained that nearby residents tend to view greenways as positive or neutral amenities that increase or have no discernible impact on property values and saleability, these results are mostly based on anecdote rather than actual market data. Using the hedonic pricing method, this study demonstrates that greenways may indeed have significant positive impacts on proximate properties' sales prices. Adjacency to a greenbelt produced significant property value premiums in two of three neighborhoods. Physical access to a greenbelt had a significant, positive impact in one case, but was insignificant in two others. No negative greenway impacts were recorded. KEYWORDS: Greenways, property values, hedonic pricing.

Nicholls, S. and J. L. Crompton (2005). "The Impact of Greenways on Property Values: Evidence from Austin, Texas." Journal of Leisure Research **37**(3): 321-341.

The effect of greenways on surrounding residential property values remains somewhat of an unknown quantity. Though several studies have ascertained that nearby residents tend to view greenways as positive or neutral amenities that increase or have no discernible impact on property values and saleability, these results are mostly based on anecdote rather than actual market data. Using the hedonic pricing method, this study demonstrates that greenways may indeed have significant positive impacts on proximate properties' sales prices. Adjacency to a greenbelt produced significant property value premiums in two of three neighborhoods. Physical access to a greenbelt had a significant, positive impact in one case, but was insignificant in two others. No negative greenway impacts were recorded. KEYWORDS: Greenways, property values, hedonic pricing.

Nicholls, S. and J. L. Crompton (2007). "The Impact of a Golf Course on Residential Property Values." Journal of Sport Management(21): 555-570.

A large proportion of golf courses currently under construction are part of larger real-estate projects. The objective of this study was to identify the magnitude of the increase in property prices created by the golf course in one such amenity. A hedonic analysis was undertaken using a sample of 305 sales transactions in a golf course subdivision in College Station, Texas. For comparative purposes, the assessed valuations of these properties were used as an alternative dependent variable. The premiums on lots adjacent to the golf course were $61,074 and $45,759, based on sales prices and assessed valuations, respectively. These premiums represented 25.8% of the average sales price of the homes, and 19.2% of the average assessed value. Prices and assessed values were also found to decline significantly with distance to the country club (by $8–10 per foot from the entrance).

Orland, B., J. Vining, et al. (1992). "The Effect of Street Trees on Perceived Values of Residential Property." Environment and Behavior **24**(3): 298-325.

Recently sold suburban residential properties in Champaign-Urbana, Illinois, were identified via a real estate agent's multiple listing service (MLS). The residences were photographed from the street, the photos digitized to create

computer files and then computer video-simulation techniques used to add three different size-class trees to the images. Public groups evaluated the individual color slide images for their expected property value and perceived attractiveness. Judged property value and attractiveness were highly correlated with the MLS recorded sales price. Tree size was not a main effect with either evaluation. For more expensive properties there was a slight increase in value for the addition of smaller trees, but a decrease associated with large trees. For less expensive properties there was no significant effect of tree presence or size. There were no effects related to subject group demographics. The results suggest the need for more caution in ascribing economic value to suburban street trees and for more research into the processes people use in weighing the risks and benefits of tree plantings. The image-editing method used in this quasi-experiment proved useful in allowing the easy manipulation of the study variable.

Overmyer, J. P., R. Noblet, et al. (2005). "Impacts of lawn-care pesticides on aquatic ecosystems in relation to property value." Environmental Pollution **137**: 263-272.

Paterson, R., M. Luger, et al. (1993). "Costs and benefits of urban erosion and sediment control: The North Carolina experience." Environmental Management **17**(2): 167-178.

Abstract The EPA's new nonpoint source pollution control requirements will soon institutionalize urban erosion and sediment pollution control practices nationwide. The public and private sector costs and social benefits associated with North Carolina's program (one of the strongest programs in the country in terms of implementation authority, staffing levels, and comprehensiveness of coverage) are examined to provide general policy guidance on questions relating to the likely burden the new best management practices will have on the development industry, the likely costs and benefits of such a program, and the feasibility of running a program on a cost recovery basis. We found that urban erosion and sediment control requirements were not particularly burdensome to the development industry (adding about 4% on average to development costs). Public-sector program costs ranged between $2.4 and $4.8 million in fiscal year 1989. Our contingent valuation survey suggests that urban households in North Carolina are willing to pay somewhere between $7.1 and $14.2 million a year to maintain current levels of sediment pollution control. Our benefit-cost analysis suggests that the overall ratio is likely to be positive, although a definitive figure is elusive. Lastly, we found that several North Carolina localities have cost recovery fee systems that are at least partially self-financing.

Paterson, R. W. and K. J. Boyle (2002). "Out of Sight, Out of Mind? Using GIS to Incorporate Visibility in Hedonic Property Value Models." Land Economics **78**(3): 417-425.

This paper uses GIS data to develop variables representing the physical extent and visibility of surrounding land use/cover features in a hedonic model of a rural/suburban residential housing market. Three equations are estimated to determine if views affect property prices and, further, if omission of visibility variables leads to omitted variable biases. To improve efficiency, first-order

spatial autoregressive models are estimated. Results indicate that the visibility measures are important determinants of prices and that their exclusion may lead to incorrect conclusions regarding the significance and signs of other environmental variables. (JEL Q21)

Payton, S., G. Lindsey, et al. (2008). "Valuing the benefits of the urban forest: a spatial hedonic approach." Journal of Environmental Planning and Management **51**: 717-736.

Pejchar, L., P. M. Morgan, et al. (2007). "Evaluating the Potential for Conservation Development: Biophysical, Economic, and Institutional Perspectives." Conservation Biology **21**(1): 69-78.

The widespread conversion of rural land to low-density residential development poses an immediate threat to biodiversity and to the provision of ecosystem services. Given that development will continue and environmental stakes are high, analyzing alternative growth strategies is critical. Conservation development is one such strategy that has the potential to benefit ecosystems and diverse stakeholders including developers, homebuyers, governments, and society as a whole. Conservation development clusters homes on one part of a property to manage the most ecologically important land for the conservation of biodiversity and ecosystem services. We draw on lessons learned from landscape ecology, open-space development, and regional planning to weigh the biophysical, economic, and institutional evidence for and against conservation development. Conservation development offers many potential environmental and economic advantages: relatively high home values and appreciation rates, lower development costs, and social and ecological benefits to society including landscape connectivity, protection and active stewardship of important ecological assets, and the maintenance of ecosystem services. But this approach also has shortcomings: it may require enlightened institutional regulations and regional planning (and/or ecologically aware developers), it is not always more profitable than conventional development and thus may require subsidies or incentives, and additional research is required to fully understand its benefits and drawbacks. With more information on the effects of clustering, the development of flexible zoning laws, and effective regional planning, conservation development could be a viable strategy for sustaining biodiversity and ecosystem services in changing landscapes.

Phaneuf, D. J., V. K. Smith, et al. (2008). "Integrating property value and local recreation models to value ecosystem services in urban watersheds." Land Economics **84**: 361-381.

Pincetl, S., J. Wolch, et al. (2003). Toward a Sustainable Los Angeles: A "Nature's Services" Approach, A Second Year Report to the John Randolph Haynes and Dora Haynes Foundation, Center for Sustainable Cities, University of Southern California.

Poudyal, N. C., D. G. Hodges, et al. (2009). "A hedonic analysis of the demand for and benefits of urban recreation parks." Land Use Policy **26**: 975-983.

Poudyal, N. C., D. G. Hodges, et al. (2009). "A hedonic analysis of the demand for and benefits of urban recreation parks." Land Use Policy **26**: 975-983.

Poudyal, N. C., D. G. Hodges, et al. (2009). "Valuing diversity and spatial pattern of open space plots in urban neighborhoods." Forest Policy and Economics **11**: 194-201.

Poudyal, N. C., D. G. Hodges, et al. (2009). "Valuing diversity and spatial pattern of open space plots in urban neighborhoods." Forest Policy and Economics **11**: 194-201.

Prado, C. M. (2005). Economics of wetlands residential and commercial land use : a Puerto Rico hedonic analysis.

> Abstract: This study focus on the land use conflict between conservation (wetland), residential and commercial land use. The construction of a commercial development in part of Las Cucharillas wetland, located in the municipality of Cataño, Puerto Rico, threatens its already fragile and deteriorated ecosystem. We used the hedonic pricing method as an indirect observed non-market valuation technique, where estimates are obtained from observed individual choices and behavior, like housing values, and inferred to estimate the environmental benefit of the service (wetland). The HPM estimates the economic value of Las Cucharillas wetland that directly affects market prices (housing prices in Catano). Therefore, the results from the HPM will help the FMDC as well as local residents to understand the variation in housing prices in the area of the projected development and consequently be able to account for any external costs or benefit involved in the relocation. The results of this study show that the proximity to Las Cucharillas wetland as well as the proximity to existent warehouses decreases the value of properties in the area surrounding the wetland. Compensation to homeowners for the loss in property values due to commercial development can be offset by restoring the converted wetland.

Qiu, Z., T. Prato, et al. (2006). "Economic Valuation of Riparian Buffer and Open Space in a Suburban Watershed." Journal of the American Water Resources Association **42**(6): 1583-1596.

> This study evaluates the economic value of riparian buffers and open space in a suburban watershed through two nonmarket valuation methods. A contingent valuation survey was implemented in the Dardenne Creek watershed, a suburban watershed of the St. Louis metropolitan area in Missouri, to evaluate the residents' perceptions of and willingness to pay (WTP) for adopting riparian buffers and preserving farmland in a hypothetical real estate market. A hedonic pricing model based on actual sale prices of homes in the watershed was applied to estimate the market value of open space and other environmental conditions such as flood zone and stream proximity in the study area. The results showed that residents' WTP was consistent with the economic values of open space and proximity to streams embedded in existing home prices. Through a better understanding of residents' perceptions and values, riparian buffer and open

space programs can be designed and promoted to achieve greater implementation success and environmental benefit.

Raucher, R. S. (2009). A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds Final Report, Stratus Consulting.

Raucher, R. S. (2009). A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds Final Report, Stratus Consulting.

Ready, R. and C. Abdalla (2003). GIS Analysis of Land Use on the Rural-Urban Fringe: The Impact of Land Use and Potential Local Disamenities on Residential Property Values and on the Location of Residential Development in Berks County, Pennsylvania, Pennsylvania State University.

Ready, R. and C. Abdalla (2003). The Impact of Open Space and Potential Local Disamenities on Residential Property Values in Berks County, Pennsylvania, Pennsylvania University.

Ready, R. C. and C. W. Abdalla (2005). "The Amenity and Disamenity Impacts of Agriculture: Estimates from a Hedonic Pricing Model." American Journal of Agricultural Economics **87**(2): 314-326.

The positive and negative externalities from farmland are increasingly a focus of public policy discussion about agriculture and land use. A GIS-based hedonic pricing model shows that agricultural open space increases nearby residential property values, but larger-scale animal operations and mushroom production have negative impacts. Animal production facilities with as few as 200 animal equivalent units reduce nearby property values, but larger facilities do not necessarily generate larger impacts. Because they tend to occur together, the negative impacts of animal agriculture and the positive impacts of open space must be simultaneously modeled to avoid omitted variable bias. [ABSTRACT FROM AUTHOR]

Roe, B., E. G. Irwin, et al. (2004). "The Effects of Farmland, Farmland Preservation, and Other Neighborhood Amenities on Housing Values and Residential Growth." Land Economics **80**(1): 55-75.

Sander, H., S. Polasky, et al. (2010). "The value of urban tree cover: A hedonic property price model in Ramsey and Dakota Counties, Minnesota, USA." Ecological Economics **69**(8): 1646-1656.

Sander, H., S. Polasky, et al. (2010). "The value of urban tree cover: A hedonic property price model in Ramsey and Dakota Counties, Minnesota, USA." Ecological Economics **69**(8): 1646-1656.

Sander, H. A. and S. Polasky (2009). "The value of views and open space: Estimates from a hedonic pricing model for Ramsey County, Minnesota, USA." Land Use Policy **26**: 837-845.

Schultz, S. and N. Schmitz (2008). How Water Resources Limit and/or Promote Residential Housing Developments in Douglas County: Final Research Report, University of Nebraska at Omaha, Economics Dept.

Sherer, P. M. (2006). The Benefits of Parks: Why America Needs More City Parks and Open Space. San Francisco, CA, The Trust for Public Land.

Shultz, S. D. and D. A. King (2001). "The use of census data for hedonic price estimates of open-space amenities and land use." Journal of Real Estate Finance and Economics **22**(2): 239-239.

Shultz, S. D. and D. A. King (2001). "The use of census data for hedonic price estimates of open-space amenities and land use." Journal of Real Estate Finance and Economics **22**(2): 239-239.

Smith, V. K., C. Poulos, et al. (2002). "Treating open space as an urban amenity." Resource and Energy Economics **24**: 107-129.

Southeast Michigan Council of Governments (SEMCOG) Information Center (2008). Low Impact Development Manual for Michigan: A Design Guide for Implementers and Reviewers, LID Magazine.

N/A

NOTES:

Stormwater Management in Michigan

basics of LID - what it is, how it compares to Smart Growth

presents case study cost comparisons and discusses benefits

Speyrer, J. F. (1989). "The effect of land-use restrictions on market values of single-family homes in Houston." The Journal of Real Estate Finance and Economics **2**(2): 117-130.

Strong, A. and R. P. Walsh (2008). "Communities, competition, spillovers, and open space." Land Economics **84**: 169-187.

Subcommittee on Water Resources and Environment and N. Stoner (2009). Testimony of Nancy Stoner Concerning Efforts to Address Urban Stormwater Runoff.

The Conservation Fund (2007). Cecil County, Maryland Green Infrastructure Plan.

The Nature Conservancy (2009). Economic Benefits of Land Conservation: A Case for Florida Forever 2009.

> Florida's unparalleled beauty and abundant natural resources enhance Floridians' quality of life and provide multiple economic benefits. The Florida Forever program is the current foundation of Florida's investment in land conservation and environmental and economic sustainability. More than 2 million acres of Florida's best and most ecologically functional lands have been preserved through Florida Forever and its predecessor, Preservation 2000, since 1990. Florida Forever and the complementary land conservation programs of local, federal and nonprofit partners represent a market-based, nonregulatory approach to protecting special places critical to the environment and quality of life in Florida. The breadth and importance of the economic benefits associated with land and natural resource conservation make a compelling case for Florida Forever and land protection across our state. The multiple economic benefits that we receive from our state's protected natural resources, however, are often not well understood or appreciated. Economic benefits of land conservation can be classified in terms of: • Tourism and Outdoor Recreation • Agriculture • Freshwater Resources • Coastal Counties and Resources • Defense and Conservation • Climate Change Mitigation • Helping Preserve the State's Green Infrastructure This remarkable range of economic activity is wholly dependent on protected natural resources and a healthy environment, policies and programs that advance sustainability in Florida, and the long and enduring support of the citizens of Florida. By recognizing the central role of the environment to our state's economy and by increasing our state's investment in its "green infrastructure," we can ensure that future generations inherit the "life support systems" that make possible Florida's high quality of life and economic prosperity. A first step in recommitting Florida to its legacy of green investment is to explore and document the range of economic benefits of natural resource conservation. A great deal of recent research on the economy and its direct link to conservation in Florida is compiled here to serve as an introduction to the economics of land conservation in Florida.

The Trust for Public Land's Center for City Park Excellence (2008). How Much Value Does the City of Philadelphia Receive from its Park and Recreation System?, for the Philadelphia Parks Alliance.

The Trust for Public Land's Center for City Park Excellence (2009). How Much Value Does the City of Wilmington Receive from Its Park and Recreation System?, The Trust for Public Land.

Thériault, M., Y. Kesten, et al. (2002). The Impact of Mature Trees on House Values and on Residential Location Choices in Quebec City**:** 478-483.

Thompson, R. (2008). Cost Benefit Analysis of Conservation Developments in Western North Carolina. Nicholas School of the Environment and Earth Sciences of Duke University, Duke University. **Master of Environmental Management**.

Thompson, R. (2008). Cost Benefit Analysis of Conservation Developments in Western North Carolina, Duke University.

Thorsnes, P. (2002). "The Value of a Suburban Forest Preserve: Estimates from Sales of Vacant Residential Building Lots." Land Economics **78**(3): 426-441.

This paper reports estimates of the market value of proximity to forest preserves as capitalized into the sale prices of vacant building lots in residential subdivisions that on one side border a preserve. The results indicate that building lots that border the preserve sell al premia of about $5,800 to $8,400(19% to 35% of tot price). 'These proximity premia appear to he highly localized. Estimates ohtained from bservations on subsequent sales of houses (rather than of vacant building lots) are larger and less precisely estimated, which sugests that omitted house characteristics may bias estimates of amenity value. (JRL Q23)

Thorsnes, P. (2002). "The Value of a Suburban Forest Preserve: Estimates from Sales of Vacant Residential Building Lots." Land Economics **78**(3): 426-441.

This paper reports estimates of the market value of proximity to forest preserves as capitalized into the sale prices of vacant building lots in residential subdivisions that on one side border a preserve. The results indicate that building lots that border the preserve sell al premia of about $5,800 to $8,400(19% to 35% of tot price). 'These proximity premia appear to he highly localized. Estimates ohtained from bservations on subsequent sales of houses (rather than of vacant building lots) are larger and less precisely estimated, which sugests that omitted house characteristics may bias estimates of amenity value. (JRL Q23)

Thurston, H. W. (2006). "Opportunity costs of residential best management practices for stormwater runoff control." Journal of Water Resources Planning and Management-Asce **132**: 89-96.

Thurston, H. W., H. C. Goddard, et al. (2003). "Controlling Storm-Water Runoff with Tradable Allowances for Impervious Surfaces." Journal of Water Resources Planning and Management **129**(5): 409-418.

Towe, C. (2009). "A Valuation of Subdivision Open Space by Type." American Journal of Agricultural Economics **91**(5): 1319-1325.

Troy, A. and J. M. Grove (2008). "Property values, parks, and crime: A hedonic analysis in Baltimore, MD." Landscape and Urban Planning **87**: 233-245.

U.S. Environmental Protection Agency (U.S. EPA). "Search - Office of Wastewater Management." from http://cfpub.epa.gov/npdes/search.cfm.

U.S. Environmental Protection Agency (U.S. EPA) (1999). EPA Phase II Stormwater Rule Qualitative Economic Benefits: Final Report.
N/A

U.S. Environmental Protection Agency (U.S. EPA) (2007). Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices, Environmental Protection Agency (EPA).
N/A

United States Environmental Protection Agency Office of Wetlands Oceans and Watersheds. "Polluted Runoff (Nonpoint Source Pollution): Economic Benefits of Runoff Controls." from http://www.epa.gov/owow/nps/runoff.html.

Wachter, S. (2005). The Determinants of Neighborhood Transformations in Philadelphia Identification and Analysis: The New Kensington Pilot Study.

Wachter, S. and K. C. Gillen (2006). Public Investment Strategies: How They Matter for Neighborhoods in Philadelphia - Identification and Analysis.

Wachter, S. and G. Wong (2008). "What is a tree worth? Green-city Strategies and Housing Prices." Real Estate Economics **36**(2): 213-239.

Walsh, R. P. (2004). Endogenous Open Space Amenities in a Locational Equilibrium, Center for Economic Analysis, University of Colorado at Bolder.
Little is known about the equilibrium impact of open space protection and growth control policies on the entire metropolitan landscape. This paper is an initial attempt to evaluate open space policies using an empirical approach that incorporates the endogeneity of both privately held open space and land conversion decisions in a locational equilibrium framework. The analysis yields four striking results. First, when one allows for endogenous adjustments in privately held open space, increasing the quantity of land in public preserves may actually lead to a decrease in the total quantity of open space in a metropolitan area. Second, different strategies for spending the same amount of money to purchase open space have markedly different welfare implications. Third, partial equilibrium welfare calculations are extremely poor predictors of their general equilibrium counterparts. And finally, the analysis suggests that while a growth ring strategy is most effective in reducing total developed acreage in the

metropolitan area, this reduction in developed acreage is associated with a large net welfare loss. In addition to its policy relevance, The paper makes two methodological contributions to the locational equilibrium literature. First, the analysis considers a Nash equilibrium with endogenous public goods where these goods arise 'naturally' as a result of land market outcomes. This is in contrast to the work of Epple, Romer, and Sieg (2001) who consider endogenous public goods that are consistent with majority voting. Second, unlike previous work with empirical locational equilibrium models, the analysis incorporates an empirically estimated supply model into the locational equilibrium framework. These methodological contributions are central to the resulting policy analysis.

Weber, T. (2007). Ecosystem Services in Cecil County's Green Infrastructure: Technical Report for the Cecil County Green Infrastructure Plan. Annapolis, MD, The Conservation Fund.

This document examines a suite of 16 ecosystem services provided by forests and wetlands in Cecil County, Maryland, and attempts to estimate their economic value, primarily based on transfers from previous studies. Most of these services lack established markets, making value estimates difficult. We employed studies and data from Cecil County where possible, within Maryland as our second choice, and elsewhere in the U.S. as a third choice. We estimated total values per acre of upland forest, riparian forests and wetlands, non-riparian wetlands, and tidal marsh, finding a range between $12,000-$77,000/acre/year. These estimates contain several weaknesses; perhaps most importantly, lacking spatial explicitness. Forests and wetlands in Cecil County provide $2.1 billion in ecosystem services each year according to our estimates. This amount is two thirds that of the county's economic output ($2.9 billion from all sectors in 2001; which is $3.3 billion in 2006 dollars), and does not include ecosystem services from bodies of water, like the Chesapeake Bay. 80% of ecosystem service value was within the Green Infrastructure, which represents 37% of the county's land. Further, large contiguous blocks of forests and wetlands (i.e., Green Infrastructure hubs) are more likely to contain fully functioning ecosystems, and more likely to provide corresponding values to humans. Protection of these areas is therefore a vital investment.

White, E. M. and L. A. Leefers (2007). "Influence of Natural Amenities on Residential Property Values in a Rural Setting." Society and Natural Resources **20**: 659-667.

Hedonic pricing has been used to identify values of nonmarket natural resource amenities. Most of these studies have been completed in suburban or urban communities rather than rural areas. The hedonic pricing study presented here includes developed residential parcel transactions occurring in a rural county in Michigan. We develop two hedonic pricing models using transaction data for two rural residential parcel types: developedparcels located in subdivisions, and developedparcels not located in subdivisions. Proximity to lakes and subdivision open areas positively affected the values of some parcel types, while proximity to forested land, publicly owned land, streams, and a National Scenic River did not have a positive influence. Results found in this study completed in a rural setting

contrast with the results of other studies completed in suburban and urban settings.

Williams, E. S. (2003). Hydrologic and Economic Impacts of Alternative Residential Land Development Methods.

Williams, E. S. and W. R. Wise (2009). "Economic Impacts of Alternative Approaches to Storm-Water Management and Land Development." Journal of Water Resources Planning and Management-Asce **135**: 537-546.

Wise, S., J. Braden, et al. (2010). Integrating Valuation Methods to Recognize Green Infrastructure's Multiple Benefits, Center for Neighborhood Technology.

Wu, J., R. M. Adams, et al. (2004). "Amenities in an Urban Equilibrium Model: Residential Development in Portland, Oregon." Land Economics **80**(1): 19-32.

This paper estimates the effects of open space and other amenities on housing prices and development density in Portland, Oregon, within the framework of an urban equilibrium model. Amenities are important: households are willing to pay more for newer houses located in areas of less dense development, with more open space, better views, less traffic congestion, and near amenity locations. For the developers, increases in housing prices results in providing more large houses, which will ultimately lead to higher density and lower housing prices. A simulation analysis evaluates policy implications and indicates substantial benefits from alterations in housing patterns. (JEL R11, R31)